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TECHNOGRAPH

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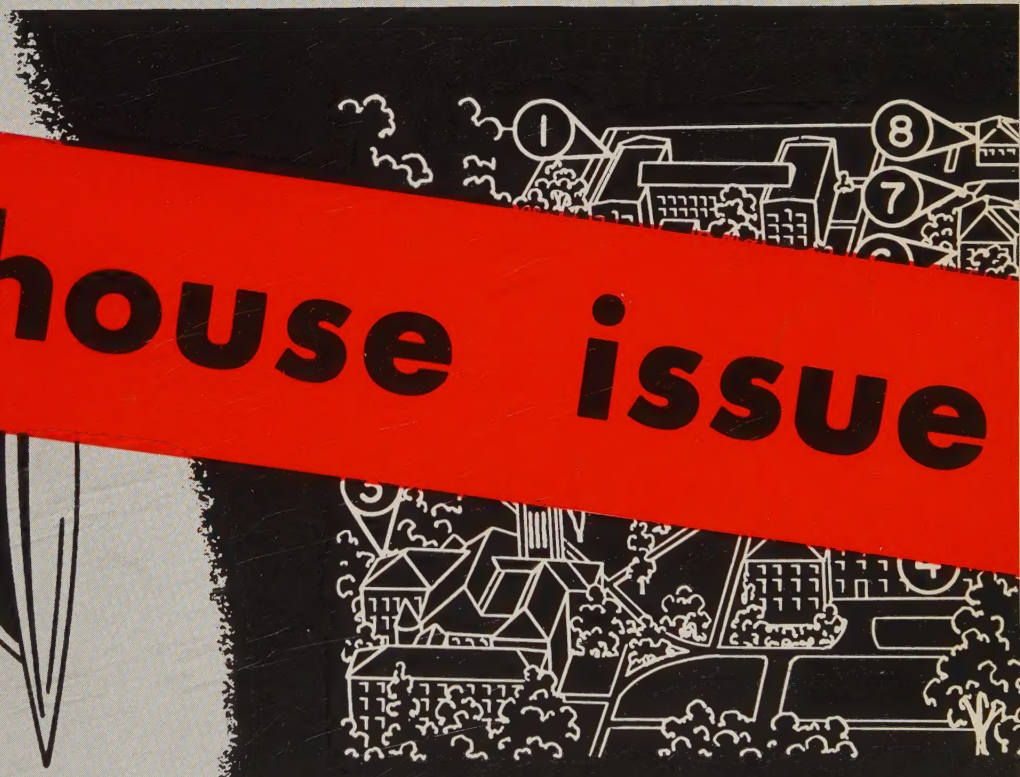

1. TALBOT LAB.
2. ELECTRICAL ENG. BLDG.
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He's making sure that "C" rations don't spoil

The tin coating on "C" ration cans does not have to be thick—but it is important that it be evenly distributed to give sure protection for the contents. But how can you measure and inspect a coating that's almost as thin as a shadow?

U. S. Steel does it with the unique X-ray gage you see in the picture. A beam of X-rays is directed at the tinplate. The rays penetrate the tin coating and cause the iron atoms in the steel *base* to fluoresce and emit X-rays of their own. As these new X-rays emerge from the base, they are partially absorbed by the tin coating. The X-rays finally leaving the tin are measured by a geiger counter and this reveals the amount of absorption and, therefore, the coating weight.

Research work like this is one of the factors that accounts for the consistent high quality of all types of steel made by United States Steel.

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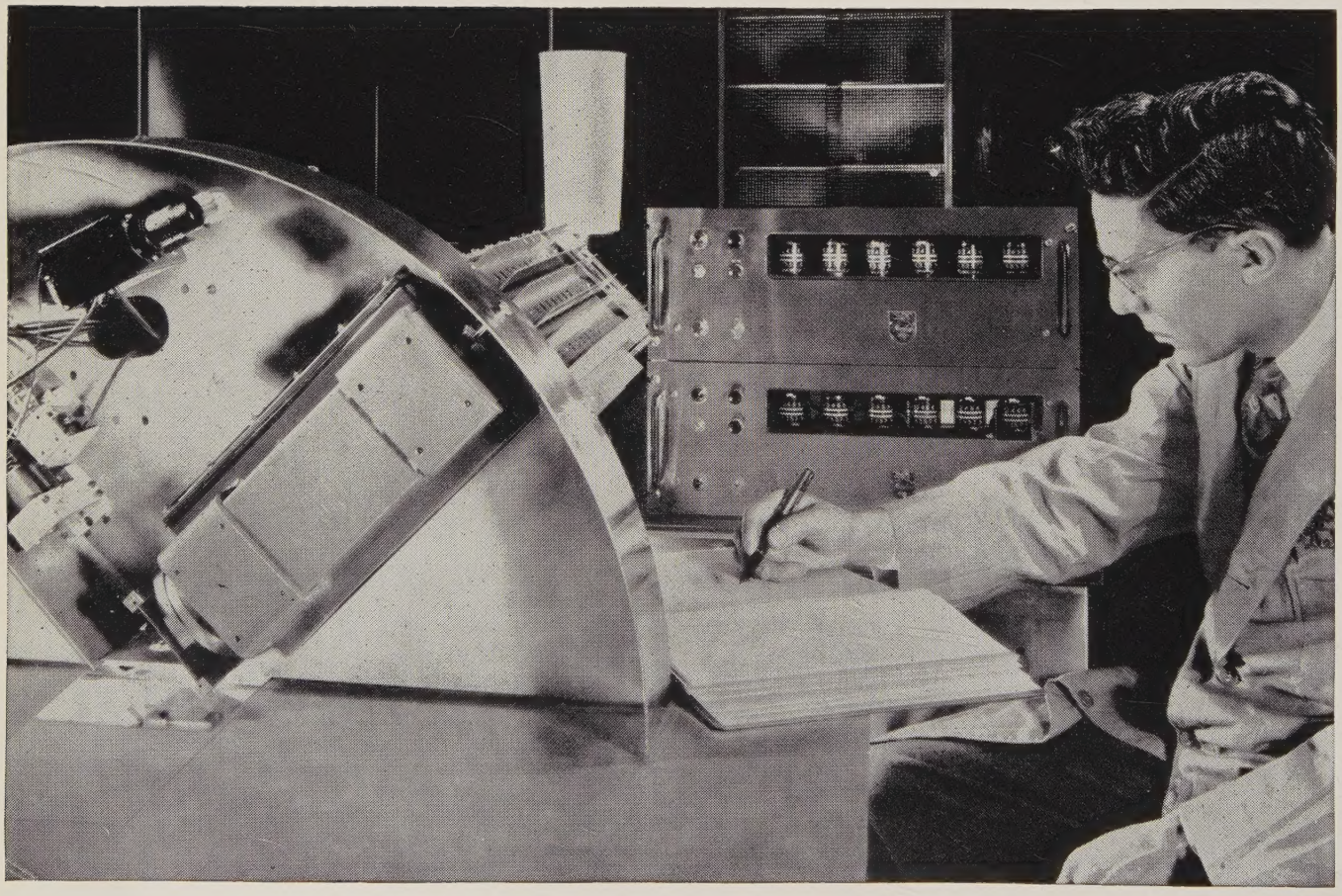
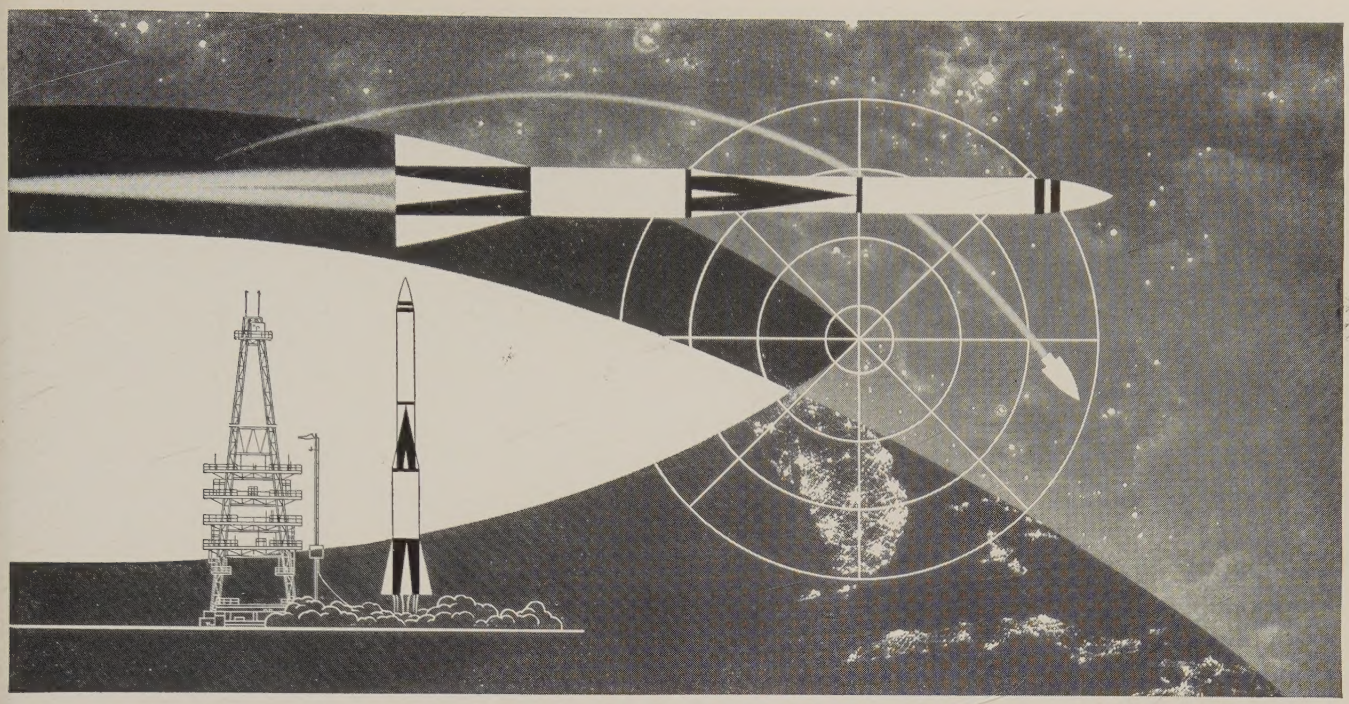


USS United States Steel



• An artist's conception of the launching of the missile, its guided flight, its track on a radarscope in its final stage.

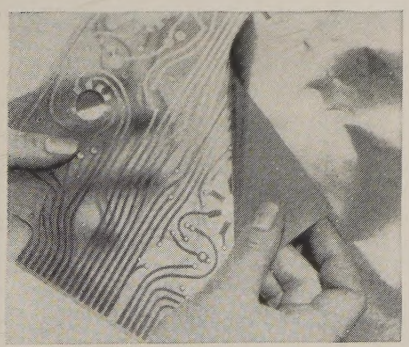
MINIATURIZATION for the MISSILE AGE

Another new design frontier for copper

"The increasing amount of equipment carried on military aircraft . . . has made it necessary for the design engineer to cram more equipment into less space."

"To achieve maximum usefulness from miniaturization, all elements of the system must be reduced to the same order of size. New design techniques, components and production methods have been developed to aid the designer in reaching this goal."
– *Electronics* Magazine

Many of these new design techniques are taking advantage of the properties of a very old material – copper. One of copper's big jobs is conducting electricity in control circuits. Of course, copper is the best commercial conductor, but when miniaturization takes over, many other properties of copper also become important.



Printed circuit of copper bonded to epoxy glass base, and sheet of the adhesive-backed copper used in its manufacture by Rubber & Asbestos Corp.

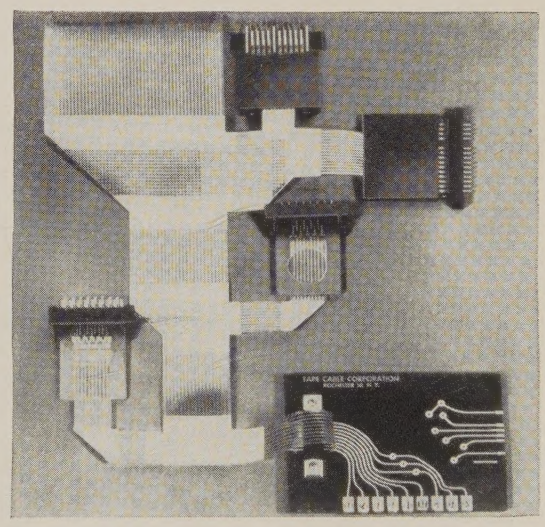
In the printed circuits that are the very basis of most subminiature designs, the conductors may start out as a sheet of copper foil. This foil often has to be very thin – yet free of flaws that might cause circuit discontinuities. Here, copper's ductility is vital.

Good joining properties are also important. Some of the tiny connections are resistance welded. (Copper can withstand the temperatures.) Others are soldered. (Easily done with copper and with very little solder metal.)

Complex control circuits can now be wired with flexible Tape Cable. This tape may contain as many as 50 copper conductors, side by side – and weigh only 2½ pounds per 100-ft. roll. The standard size of each of the rectangular conductors in the tape is 0.0015 in. by 0.03 in.

Obviously, with such small cross sections, no deterioration of the conductor is permissible. Yet temperatures, particularly in missile applications, are high. The answer is found in copper which is free of oxygen—eliminating oxidation, scale formation and conductivity losses.

In other high temperature applications, copper's high thermal conductivity can be used to protect more delicate parts from excessive heat. For this reason it is useful in missile nose cones. And, of course, copper's excellent corrosion resistance is often valuable in exposed parts and in tubing.

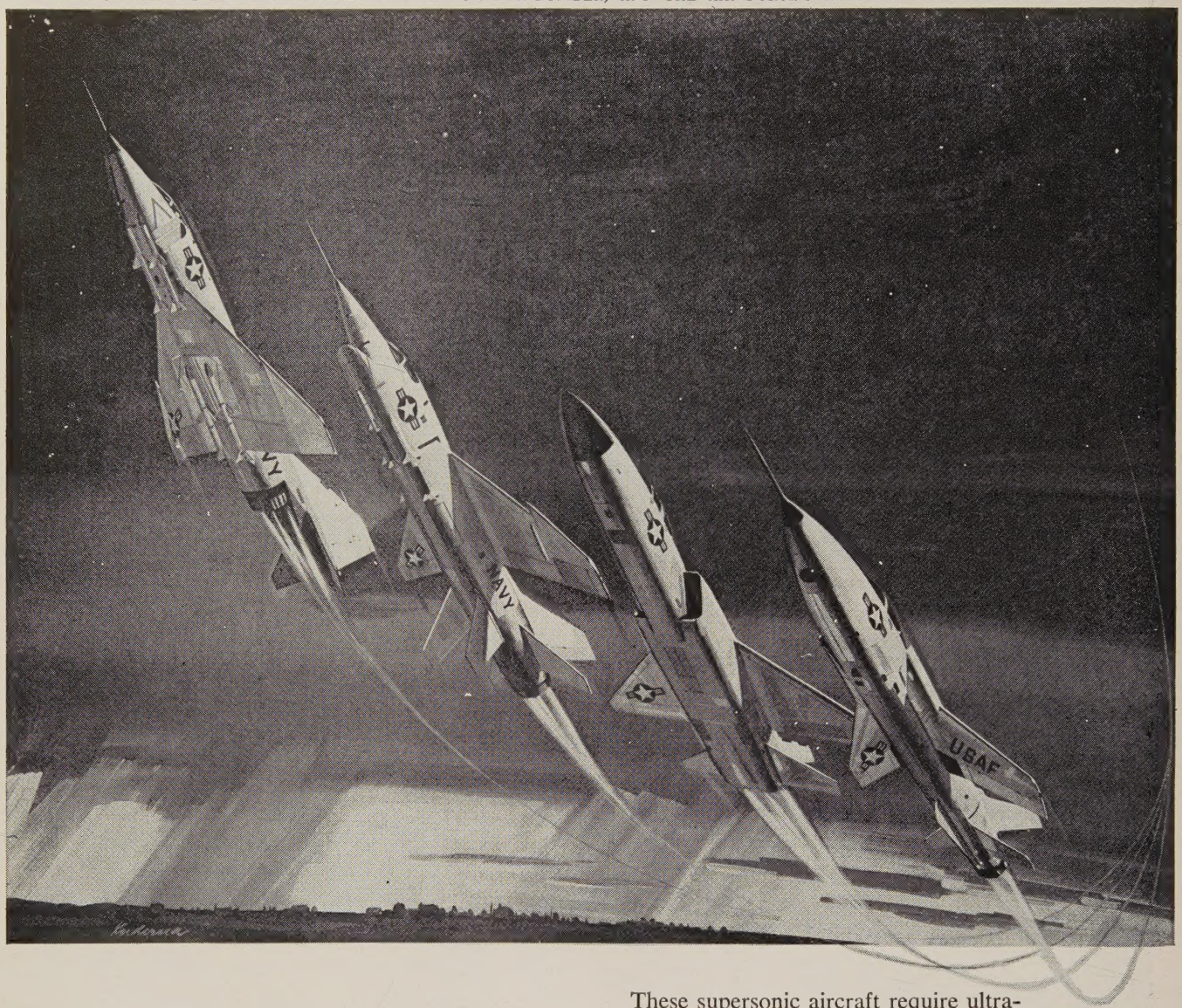


Wiring harness of Tape Cable provides flexible, flat 50-conductor interconnection system.

The field of missiles and rocketry is but another example of a design frontier where the versatility of copper and the copper alloys helps make progress possible.

If you'd like to know more about these metals and their design possibilities, send for "A Guide to Copper and its Alloys." Write The Copper & Brass Research Association, 420 Lexington Avenue, New York 17, New York.

COLLINS SYSTEMS ARE NOW IN PRODUCTION FOR (LEFT TO RIGHT) THE NAVY'S McDONNELL F4H-1 AND CHANCE VOUGHT F8U-3 FIGHTERS AND NORTH AMERICAN A3J-1 ATTACK BOMBER, AND THE AIR FORCE'S REPUBLIC F-105 FIGHTER-BOMBER.



why America's newest jets use COLLINS ELECTRONICS

These supersonic aircraft require ultra-dependable electronics systems, highly specialized for communication, navigation and radar identification. Such systems must be integrated, adaptable to the varying airframe requirements of today's newest jets.

Collins integrated electronics systems achieve building-block flexibility through modular design of all basic units. Designed *into* each aircraft, a space-saving *custom* Collins system retains the economy of standardized production and simplified maintenance.

These specialized electronics packages are an important part of Collins' contribution toward greater defense per dollar.

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ENGINEERS — At Collins you receive professional recognition, unlimited opportunity, the most completely equipped research and development facilities, the opportunity to work on the most challenging, developments in electronics. Your placement office will tell you when a representative will be on campus. Or write for illustrated brochure "Career with Collins," to one of the addresses below.

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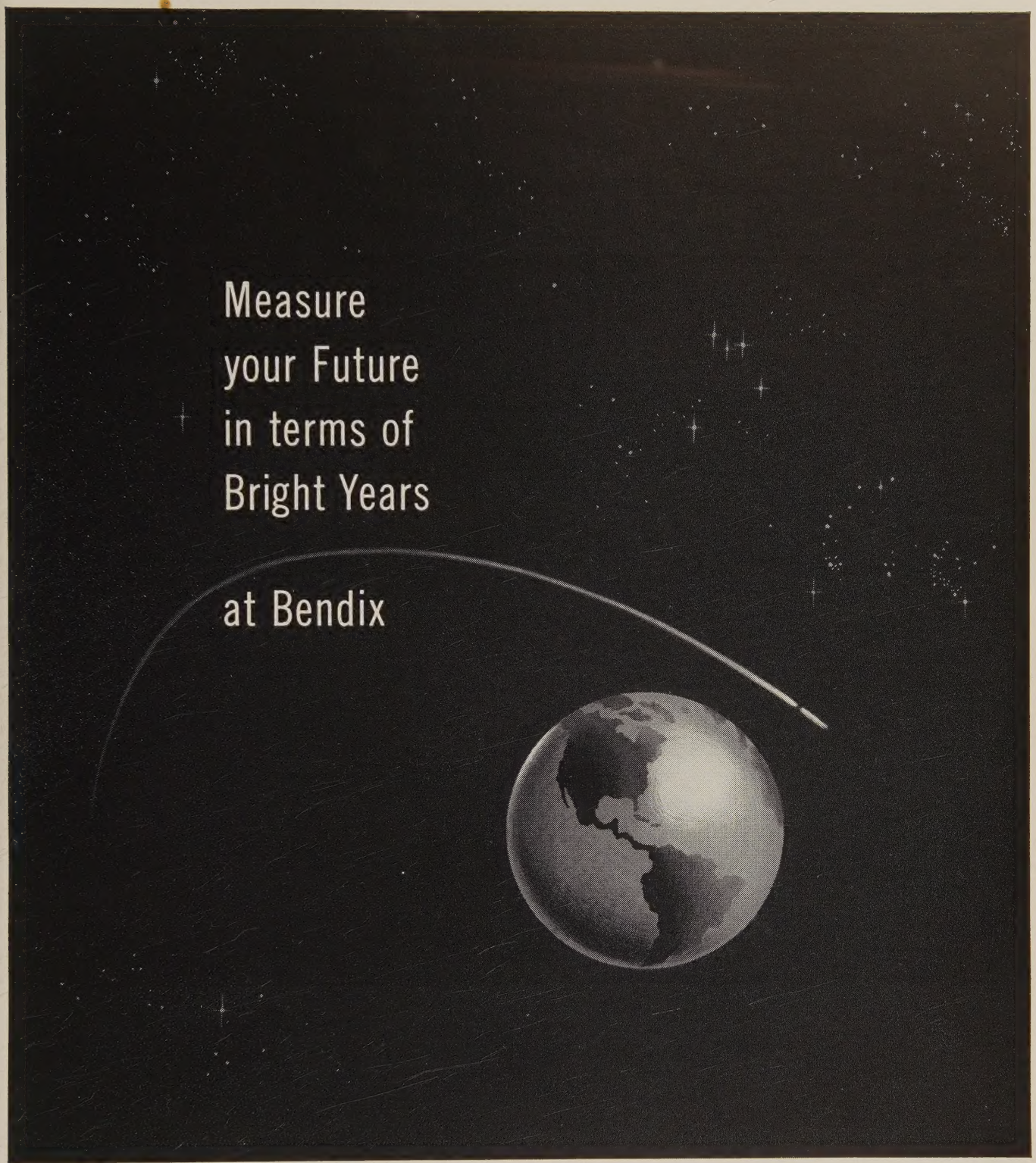


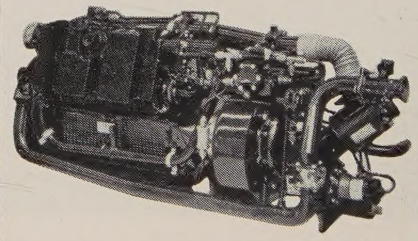
The distance between your college education and a bright engineering future at Bendix is measured entirely by your talent and ambition. Fine opportunities await able young engineers at the many growing Bendix divisions located throughout the country. Investigate Bendix career opportunities in such fields as electronics, electromechanics, ultrasonics, systems, computers, automation and controls, radar, nucleonics, combustion, air navigation, hydraulics, instrumentation, propulsion, metallurgy, communications, carburetion, solid-state physics, aerophysics and structures. Contact your placement director regarding Bendix and interview dates, or write Director of University and Scientific Relations, Bendix Aviation Corporation, 1108 Fisher Building, Detroit 2, Michigan.

A thousand products Bendix AVIATION CORPORATION Fisher Bldg., Detroit 2, Mich. *a million ideas*

Prelude to space

The U. S. Air Force's LOCKHEED F-104A STARFIGHTER, fastest production airplane in the world, is one of the current crop of military aircraft whose extreme speeds and operating altitudes typify the problems of projecting man into space and keeping him alive. HAMILTON STANDARD designs and builds the air conditioning, engine fuel control and engine starter equipment for the F-104A and other leading supersonic aircraft. This experience is now being used as the springboard for investigations into the problems of environmental control for human survival in space.

The refrigeration package shown at the right which Hamilton Standard builds for the F-104A has the capacity to cool a seven to nine room house and weighs only 50 lbs.



If you are interested in sharing in the fascinating work that will help make possible man's new age of flight, contact:
MR. TIMOTHY K. BYE
Engineering Personnel Coordinator
or arrange for an interview with your college recruitment officer.

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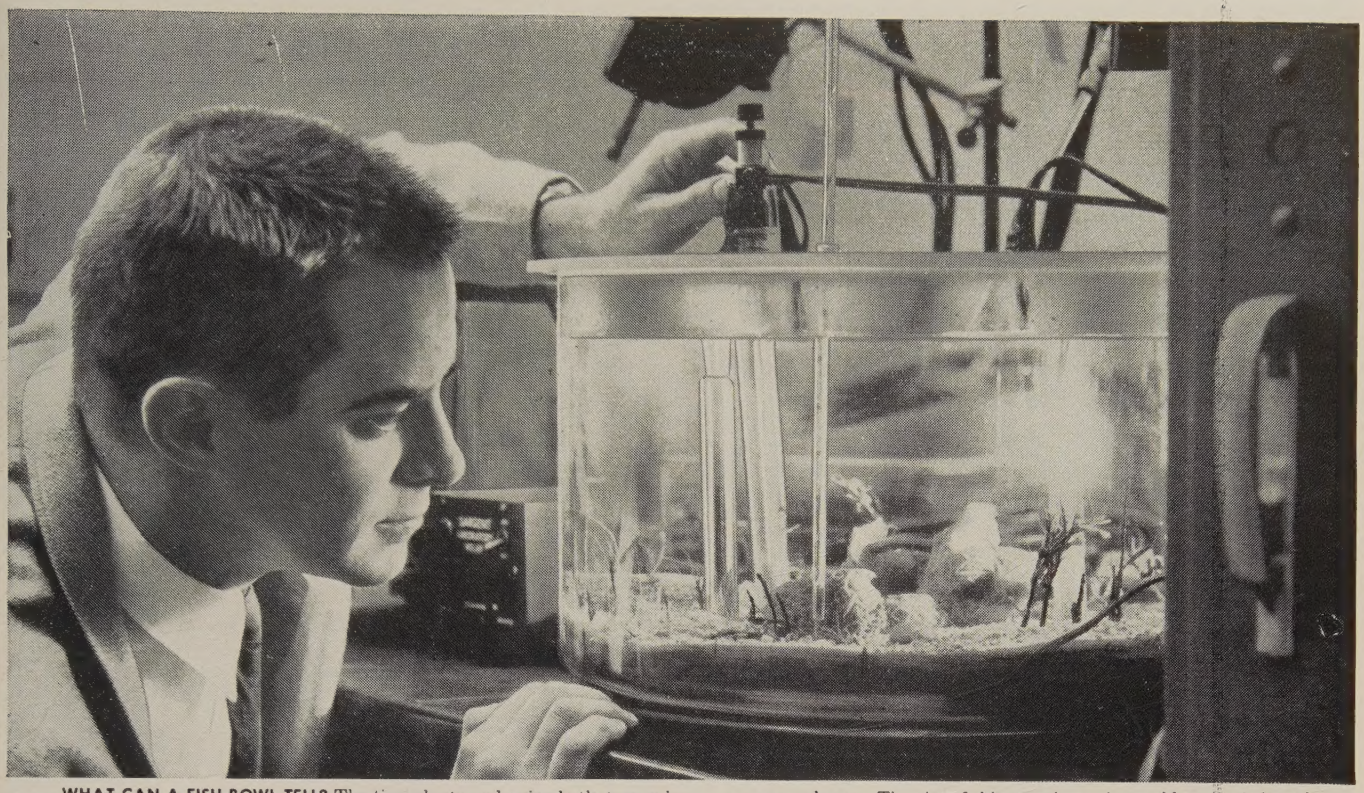
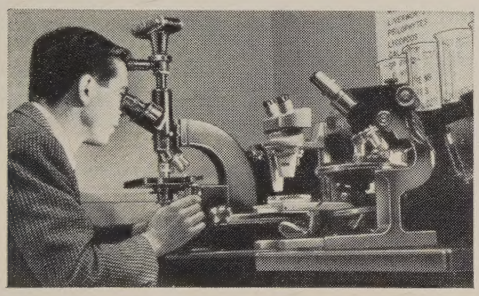


WHAT CAN A FISH BOWL TELL? The tiny plants and animals that grow in this "fish bowl" will be similar to those that grew in oceans fifty million years ago and more. The aim of this experiment is to add to man's knowledge of where to look for oil deposits. Pictured is Dr. F. G. Stehli.



HAY FEVER SUFFERERS may be interested to know that pollen is helpful—in the search for oil, that is. Here Dr. A. T. Cross studies traces of pollen in rock millions of years old to interpret underground formations. A comparatively new science, this study of ancient pollen opens previously explored areas to new examination.

THE SEARCH FOR OIL goes on in some of the most inaccessible regions in the world. And expensive, specially-built equipment like this "swamp buggy" is needed to overcome the obstacles of nature and to find more new oil every year than is taken out of the ground.

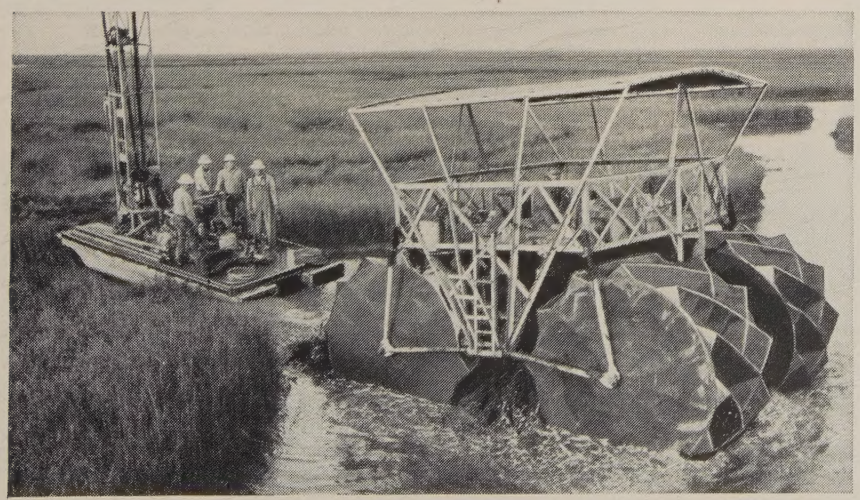
Time turned back 50 million years; Scientists seek new clues to oil!

Tiny marine plants and animals, very like those living when dinosaurs roamed the earth, are being grown today in a research laboratory.

In glass containers similar to fish bowls, scientists of Pan American Petroleum Corporation, a Standard Oil affiliate, have transplanted sand and sea water from an ocean shore line. Then, by controlling temperature, pressure and salt content, they have simulated the environment of plants and animals that grew 50 to 300 million years ago.

The chemical composition of the microscopic life that grows in the laboratory will offer more positive clues to the type of environment of ancient fossils; that is, whether the tiny animals lived and died in deep, shallow, or protected water.

This knowledge will help scientists to map ancient seas with greater accuracy, to pinpoint the location of prehistoric shore lines and barrier reefs where conditions were ideal for oil to form. Such knowledge will improve our ability to find oil in sufficient quantities to meet today's steadily increasing needs.



This is another example of the way research works at Standard and its affiliates to discover quicker, surer methods of finding oil, to keep the supply up and the price down.

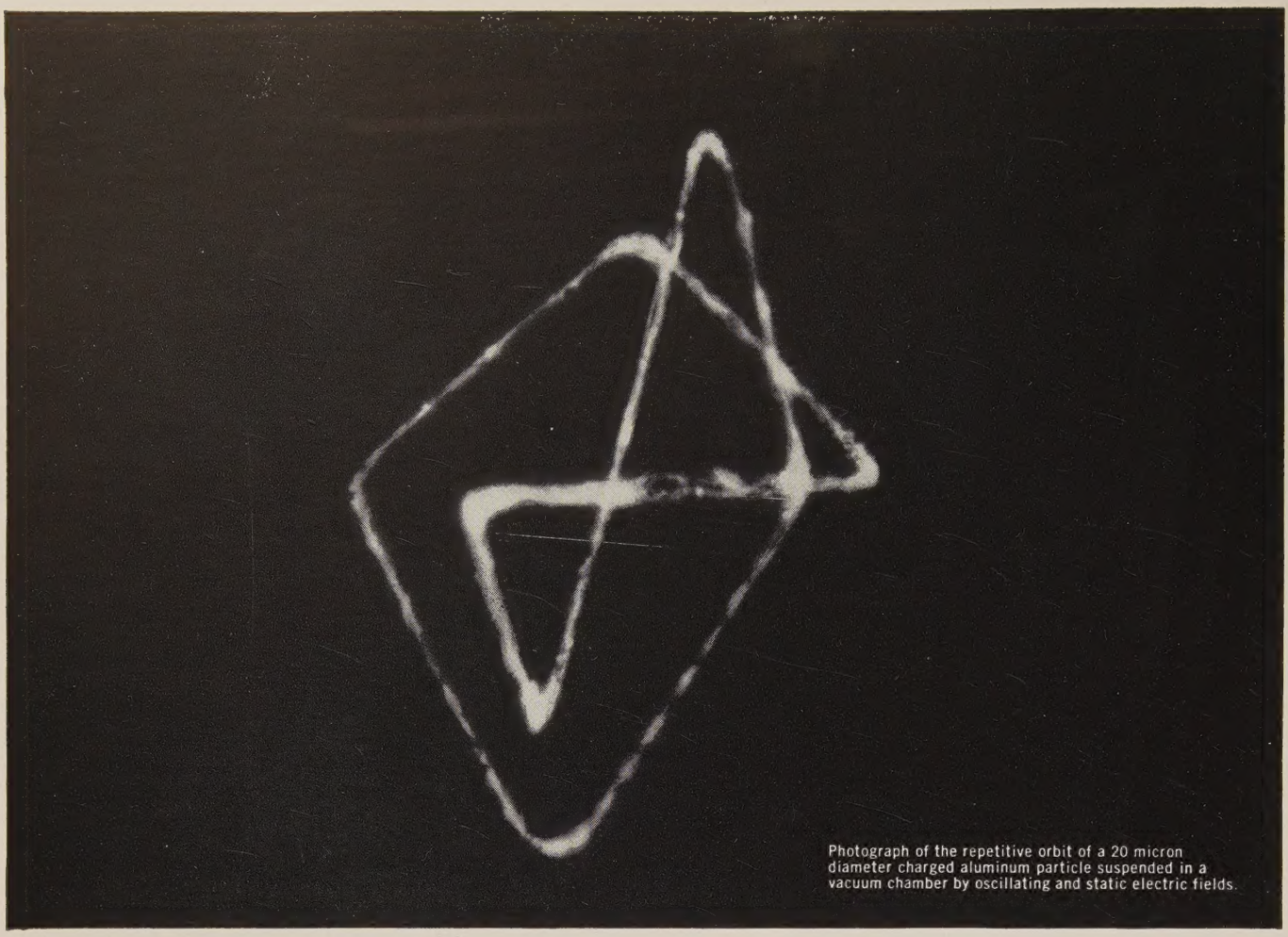
As the result of such trail-blazing research work as the fish bowl project, America's proved underground reserves have grown larger, prices have remained reasonable, and America has been assured of an adequate supply to keep its defenses strong.

What makes a company a good citizen? One measure is a company's concern for the welfare of future generations. In our business, a "let-tomorrow-take-care-of-itself" attitude would be disastrous. Through research, we at Standard are working to make life more comfortable and secure for all—today and for the future.

STANDARD

STANDARD OIL COMPANY

THE SIGN OF PROGRESS...
THROUGH RESEARCH



Photograph of the repetitive orbit of a 20 micron diameter charged aluminum particle suspended in a vacuum chamber by oscillating and static electric fields.

ELECTRODYNAMIC ORBITS

By the application of properly chosen alternating and static electric fields, electrically charged particles can be maintained in dynamic equilibrium in a vacuum against interparticle and gravitational forces. This is illustrated in the above photograph of the orbit of a charged dust particle. During the time of exposure the particle traversed the closed orbit several times, yet it retraced its complicated path so accurately that its various passages can barely be distinguished.

The range of particles of different charge-to-mass ratios which can be contained in this manner is determined by the gradients of the static and alternating electric field intensities and by the frequencies of the latter. In the absence of static fields and for a given electric field strength, the minimum frequency required for stable containment of the particles is proportional to the square root of their charge-to-mass ratios. Thus, charged colloidal particles require the use of audio frequencies, atomic ions need HF frequencies, while electrons require the use of VHF and higher frequencies.

Under the confining influence of the external fields, the particles are forced to vibrate with a lower frequency of motion which is determined by the external field intensities, space charge, and the driving frequencies. If the initial thermal energy is removed, a number of particles may be suspended in space in the form of a crystalline array which reflects the symmetry properties of the external electrodes. These "space crystals" can be repeatedly "melted" and re-formed by increasing and decreasing the effective electrical binding force. These techniques offer a new approach in the study of plasma problems and mass spectroscopy in what may be properly termed "Electrohydrodynamics."

At The Ramo-Wooldridge Corporation, work is in progress in this and other new and interesting fields. Scientists and engineers are invited to explore current openings in Electronic Reconnaissance and Countermeasures; Microwave Techniques; Infrared; Analog and Digital Computers; Air Navigation and Traffic Control; Antisubmarine Warfare; Electronic Language Translation; Radio and Wireline Communication, and Basic Electronic Research.

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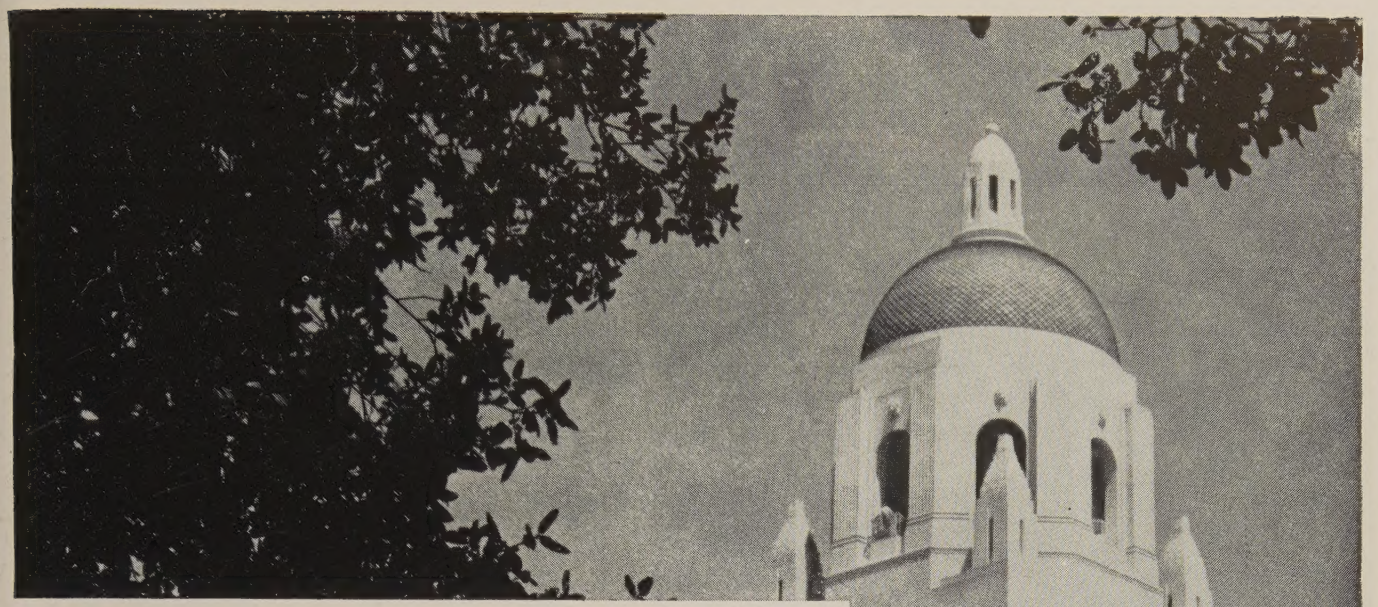

Why Lockheed –

Lockheed's leadership in aircraft is continuing in missiles. The Missile Systems Division is one of the largest in the industry and its reputation is attested by the number of high-priority, long-term projects it holds: the Polaris IRBM, Earth Satellite, Kingfisher (Q-5) and the X-7. To carry out such complex projects, the frontiers of technology in all areas must be expanded. Lockheed's laboratories at Sunnyvale and Palo Alto, California, provide the most advanced equipment for research and development, including complete test facilities and one of the most up-to-date computing centers in the nation. Employee benefits are among the best in the industry.

For those who qualify and desire to continue their education, the Graduate Study Program enables them to obtain M.S. or Ph.D degrees at Stanford or the University of California, while employed in their chosen fields at Lockheed.

Lockheed Missile Systems Division was recently honored at the first National Missile Industry Conference as "the organization that contributed most in the past year to the development of the art of missiles and astronautics."

For additional information, write Mr. R. C. Beverstock, College Relations Director, Lockheed Missile Systems Division, Sunnyvale , California.

Lockheed / MISSILE SYSTEMS DIVISION

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, VANDENBERG AFB, CALIFORNIA
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Francis Thompson joined Westinghouse in 1952– has since earned M.S. degree and 10 U.S. patents

At 28, Francis T. Thompson, a 1952 B.E.E. graduate of Rensselaer Polytechnical Institute, is an engineer on his way to a distinguished career *in a hurry!*

Upon completion of the Westinghouse Student Training Course, he was immediately selected to attend the Advanced Design Course at the University of Pittsburgh. Upon completion of this course, he was assigned to the Research Laboratories where he worked on color TV and high definition TV projects. Since August, 1957, he has been assigned to the New Products Dept. where he has developed a transistorized control system combining both digital and analogue equipment to regulate steam turbines in paper plant applications.

Most important, *Francis Thompson is doing exactly what he wants to be doing.* He earned his MS degree through the Westinghouse Graduate Study Program in 1955 and is now working toward his Ph.D. Active in the IRE, he has submitted 45 patent disclosures (which have already resulted in awards totaling more than $1,000.00); and he has 10 U.S. patents pending.

Francis Thompson is one of many talented young engineers who are finding rewarding careers with Westinghouse. You can, too, if you've got ambition and you're a man of exceptional ability. Our broad product line and decentralized operations provide a diversity of challenging opportunities for talented engineers. Guided missile controls, atomic power, automation, radar, semiconductors, and large power equipment are only a few of the fascinating career fields to be found at Westinghouse.

Why not find out now about the opportunities for *you* at Westinghouse? Write to Mr. L. H. Noggle, Westinghouse Educational Center, Ardmore & Brinton Roads, Pittsburgh 21, Pennsylvania.

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THE ILLINOIS TECHNOGRAPH

Volume 74, Number 3 **December, 1958**

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Cover . . .

The Open House poster has been modified by our artist, "Dusty" Rhodes, to present the theme of this issue. The Open House articles will not only give a preview of this year's program, but will also summarize each engineering field as to its purpose and opportunities.

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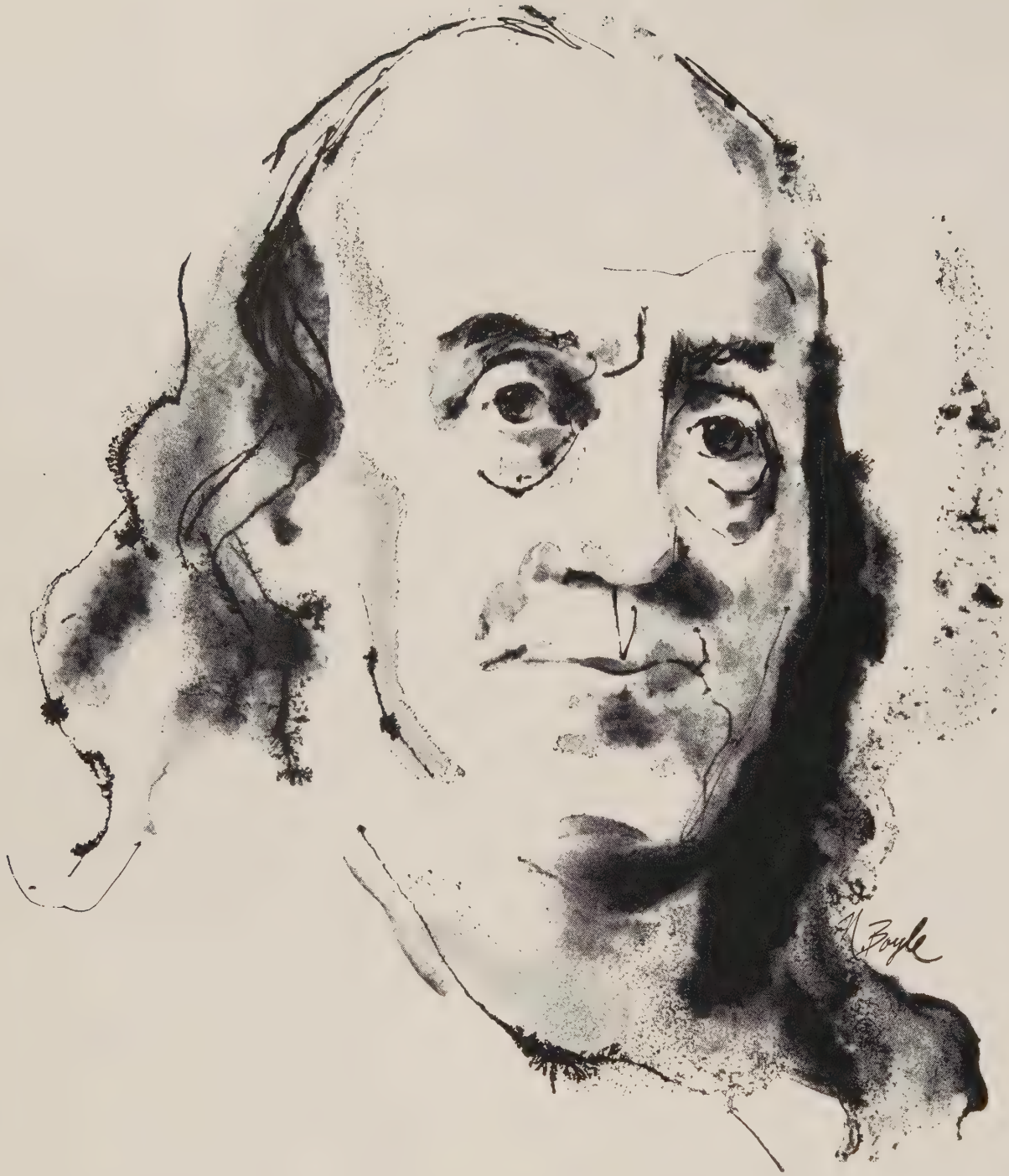


Benjamin Franklin...on science and humanity

"The rapid progress *true* science now makes, occasions my regretting sometimes that I was born so soon. It is impossible to imagine the height to which may be carried, in a thousand years, the power of man over matter. We may perhaps learn to deprive large masses of their gravity, and give them absolute levity, for the sake of easy transport. Agriculture may diminish its labor and double its produce; all diseases may by sure means be prevented or cured, not excepting even that of old age, and our lives lengthened at pleasure even beyond the antediluvian standard. O that moral science were in as fair a way of improvement, that men would cease to be wolves to one another, and that human beings would at length learn what they now improperly call humanity!"

—Letter to Joseph Priestley, February 8, 1780

THE RAND CORPORATION, SANTA MONICA, CALIFORNIA

A nonprofit organization engaged in research on problems related to national security and the public interest

Lethargy . . .

Lethargy is a word widely misused, especially in regard to engineering students. As Webster defines the word it implies a disinclination to move. Certainly engineering students are moving, however, we tend to move in a rather restricted path. The scholastic work which is required of us is extensive, this is understood, but we as prospective engineers must not forget our obligation to society as well as to formal studies. An education includes more than the fundamentals of physical phenomena. It must also include insight into mental phenomena. While engineering courses teach us the first we must learn the second through experience. If we are to be considered more than bearded calculating machines with slide rules swinging at our sides we must take an active part in life itself.

While students in other schools sit and talk of the stagnation of the mind caused by technical education, we are in a position to show otherwise. We not only have the potential to aid mankind technically, but the opportunity to apply our knowledge in many fields. The realization that a man is no better than his purpose in life can cause any student to pause and take stock of himself. While an engineer seems limited in his opportunities, current trends have shown that jobs requiring a knowledge of people as well as machines are open to the graduate engineer.

With this in mind, one stops to consider if he has learned as much about people in his years at college as he has about engineering. The technical student owes an obligation to himself and society to be educated in both fields.

While these words can be written easily and read with little concern, their theme is of great importance. We must be willing to move, not only at the steady pace required for survival, but at the rapid pace required to lead.

WDP

A Preview of . . .

OPEN HOUSE FOR 1959

When a school as large as the University of Illinois puts its facilities on display to the public the result is bound to be a rewarding experience for all concerned. While the campus is open for visitors at any time, a special week end is set aside specifically for engineering campus. This is known as Engineering Open House. The program is aimed at the high school student and each year students throughout the state are introduced to the challenge of engineering. Through the various displays they are given a feeling for the prowess of the engineering field. While each department specializes to a great extent, the overall effect of the open house is a broadening of the engineering concept. And this is as it should be for the most important thing is the combination of qualities that each engineer shares with his fellow engineers.

This year's open house will be for the two day period of March 13 and 14. The heaquarters for the Engineering Open House will be on the first floor of Civil Engineering Hall. Guided tours will originate from this office periodically. There will also be tours of the campus area including the quadrangle and a men's or women's residence hall.

Free parking will be furnished for visitors of the open house program. Permits may be obtained at the Open House headquarters. Also food will be served at the cafeteria in the basement of the Illini Union.

As for the displays themselves, each department will present equipment which not only has audience appeal, but also exemplifies the type of work possible in the particular field.

The Aeronautical Engineering Department will have well over a dozen displays including a high speed wind tunnel, a turboprop engine, and a plasma-jet generator. Many other displays of equal interest are included in their program and promise to intrigue those who view them.

Of great interest to those seeing the Agricultural Engineering display will be the structure in which it is housed. The giant balloon like tent known as an air dome is supported solely by air pressure obtained from a crop dryer located at one end of the structure. The displays themselves will include a reversing direction split phase motor, an auger used to convey water, a soils demonstration, and a test showing the effect of spark advance on horsepower output of a tractor engine.

The Ceramic Engineering Department has planned displays which will give a complete picture of the various fields which are served by the ceramic engineer. They will range from samples of ceramic products to the operation of displays which are models of the processes used in industry. A series of movies will be shown emphasizing modern applications in industry. Some of

Shown above is the air dome as will be used to house the Agriculture display. At the left is the apparatus used to hold the structure in position.

the displays will include a replica of the tunnel kilns used in the jewelry industry and equipment used in the science of pyrometry or temperature measurement and control.

The Chemical Engineering displays will be housed entirely in the East Chemistry Building. The main display will be the unit operations laboratory where the pilot plant type equipment is located. While all the equipment will not be in operation its function and use will be described. The highlight of the display will be the chemistry magic show. During this half hour show many curious chemical phenomena will be demonstrated. Other exhibits will include a chemical products display, a radio-chemistry display, and senior and graduate research projects.

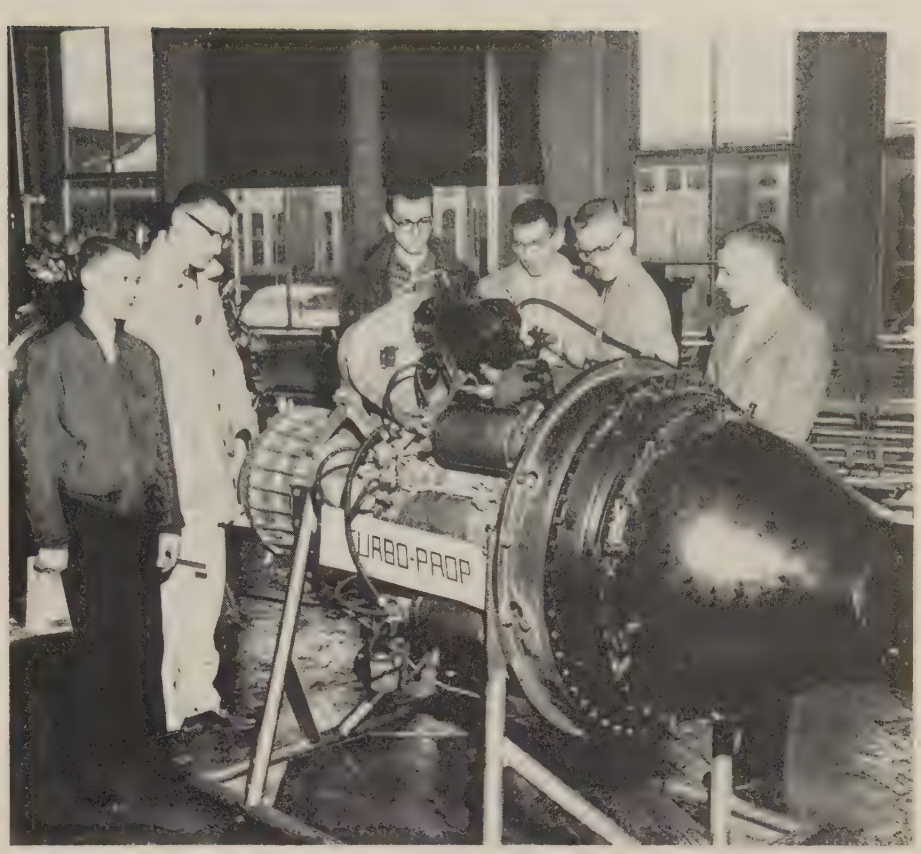
Civil Engineering is a field of very wide scope and therefore will have numerous displays of interest. A topographic map of the Champaign-Urbana area proves to be of great interest. This map was a student project. Also a model of a typical town with reservoir, water supply and sewage treatment plants will be on display. Numerous student design problems as well as industrial projects such as Convair Aircraft samples will be available for your study. Other projects concerning highways, railroads, and structural research will be explained as well as a series of movies which will typlify projects undertaken by the Civil Engineer.

The Electrical Engineering Department plans to use the Bell Telephone Company display TIC - TAC - TOE which gained so much popularity last year. This, however, is not the display of most importance for it merely shows one application of electrical equipment. The research and development that must be done before useful devices may be designed will be exemplified through numerous lab displays. Included in the practical exhibits will be a TV set up and a Hi-Fi set up.

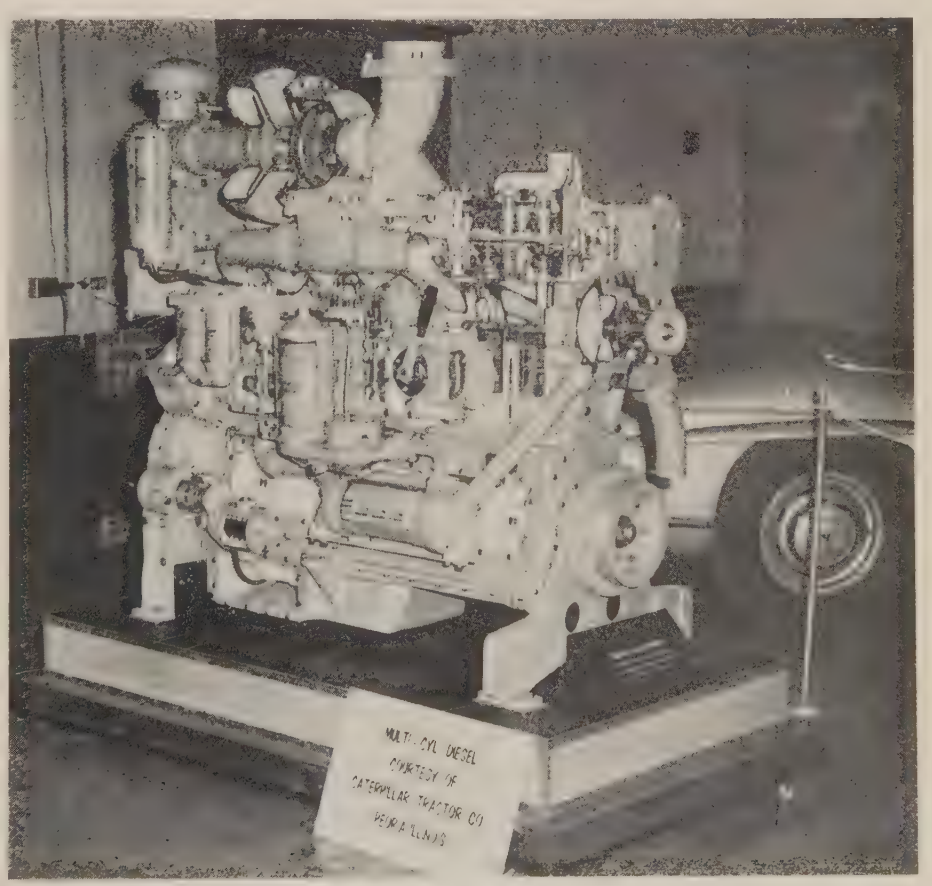
Drawing is the universal language and the job of the General Engineering Department is to train men capable of this and many other skills. Student problems and projects will be on display including production illustration, descriptive geometry, machine drawing, aircraft drafting and many others. Demonstrations of the airbrush, the pantograph, and the ellipse machine as well as many different slide rules will be available to the interested viewer.

Mechanical Engineering displays will be set up in the M. E. Lab. and the foundry as well as the M. E. Building. Internal combustion engines, heat treatment of metals, welding processes, and foundry processes are but a few of the displays planned for this department. The A.S.M.E. and Pi Tau Sig-

(Continued on Next Page)



This turbo-prop engine is one of the many displays which the Aeronautical Engineering Department will have to offer in their Open House program.



This multi-cylinder diesel engine on display in the Mechanical Engineering Building has numerous cut away views to show the internal mechanisms and their functions.

The three million pound testing machine is shown in action. Tests such as these will be run on concrete cylinders periodically throughout the Open House weekend by the TAM Department.

ma will have information booths set up on the first floor of the M. E. Building and movies will also be shown in that building concerning the mechanical engineering processes and techniques.

The Metallurgy Department plans to build its display around exhibits concerning phase transformation, corrosion in action, annodizing of aluminum and numerous other subjects of interest. The department also intends to obtain displays from Bethlehem Steel. A continuous production of souvenir ash trays will explain simply the steps involved in casting.

The Mining Engineering displays will include mining exhibits showing automatic hoisting processes, procedures for gas testing, ventilation control and many others. The petroleum exhibits include well servicing equipment and an electrical pumping unit. The displays will be located in the Mining Lab. directly behind the Transportation Building.

The Physics department will have exhibits concerning mechanics, electromagnetism, nuclear physics, and light. Of special interest should be the Betatron and Cyclotron which will be explained on a guided tour. Free buses will leave to their locations every half hour.

The Theoretical and Applied Mechanics Department will operate their three million pound testing machine at various times during the two day period. Numerous other material testing devices will be on display throughout the building. The department is introducing this year a new curriculum leading to a Bachelor of Science degree in Engineering Mechanics. People wishing additional information on this subject should check in room 220 of Talbot Lab.

The Army, Navy, and Air Force R.O.T.C. will also have exhibits showing the various technical aspects and branches of service available. Such things as ordinance, flight equipment, and emergency structures including floating bridges will be on display.

As can be seen from the various information given this Open House will be of very broad scope and will have displays of interest to everyone. This is an excellent opportunity for people to see what is happening in the departments they seldom have contact with otherwise. Also for those still deciding on their future this is an opportunity that should not be missed. We look for you all at the 1959 Engineering Open House.

ST. PAT'S BALL

The St. Pat's Ball will be held Mar. 14, 9 p.m. to 1 p.m., in Huff Gym. Everyone is invited. Tickets are $3.00 per couple and may be purchased at the Illini Union Box Office.

Russ Carlyle and his band will be there for your entertainment.

The Knights of St. Pat will be dubbed and the Queen will be elected by those attending the dance.

The Blarney Stone will be present barring any unforseen accidents.

NUCLEAR ENGINEERING PROGRAM

At The University of Illinois

Now in its second year, the nuclear engineering program is a curriculum for graduate students who hold degrees in engineering, physics, or chemistry. This new field, which stems from atomic and nuclear physics and familiar engineering curriculums such as metallurgical, chemical, electrical, and mechanical engineering offers a wide and varied range of opportunities and challenging problems on the frontiers of present technology.

Some of the problems of immediate interest include reactor development for power generation and propulsion as well as the use of nuclear radiation in industry and medicine. Corrosion, heat transfer, and stress analysis problems common to all power systems present new difficulties in nuclear power reactors because of the extreme temperature and radiation conditions encountered. Also, with new materials containing uncommon elements such as beryllium, zirconium, thorium, uranium, and their compounds and alloys being used in the construction and operation of reactors, metallurgy is a key field for nuclear developments.

Likewise, reactor control, instrumentation, and remote control facilities offer many important applications for the concepts and devices of electronics and servomechanisms. To look further ahead, plasma physics[1] and controlled thermonuclear reactions are presently at the frontier of research and development and will continue to be so. Inter-relations among the fields of nuclear and solid state physics and the engineering curriculums are therefore essential for success in new projects. Nuclear engineering is consequently a graduate subject with exceptional opportunities for a student having interests in modern physics or mathematics.

The program as it exists here at the University of Illinois allows considerable flexibility. A first alternative leads to an M.S. Degree in Nuclear Engineering for students interested in immediate industrial employment.

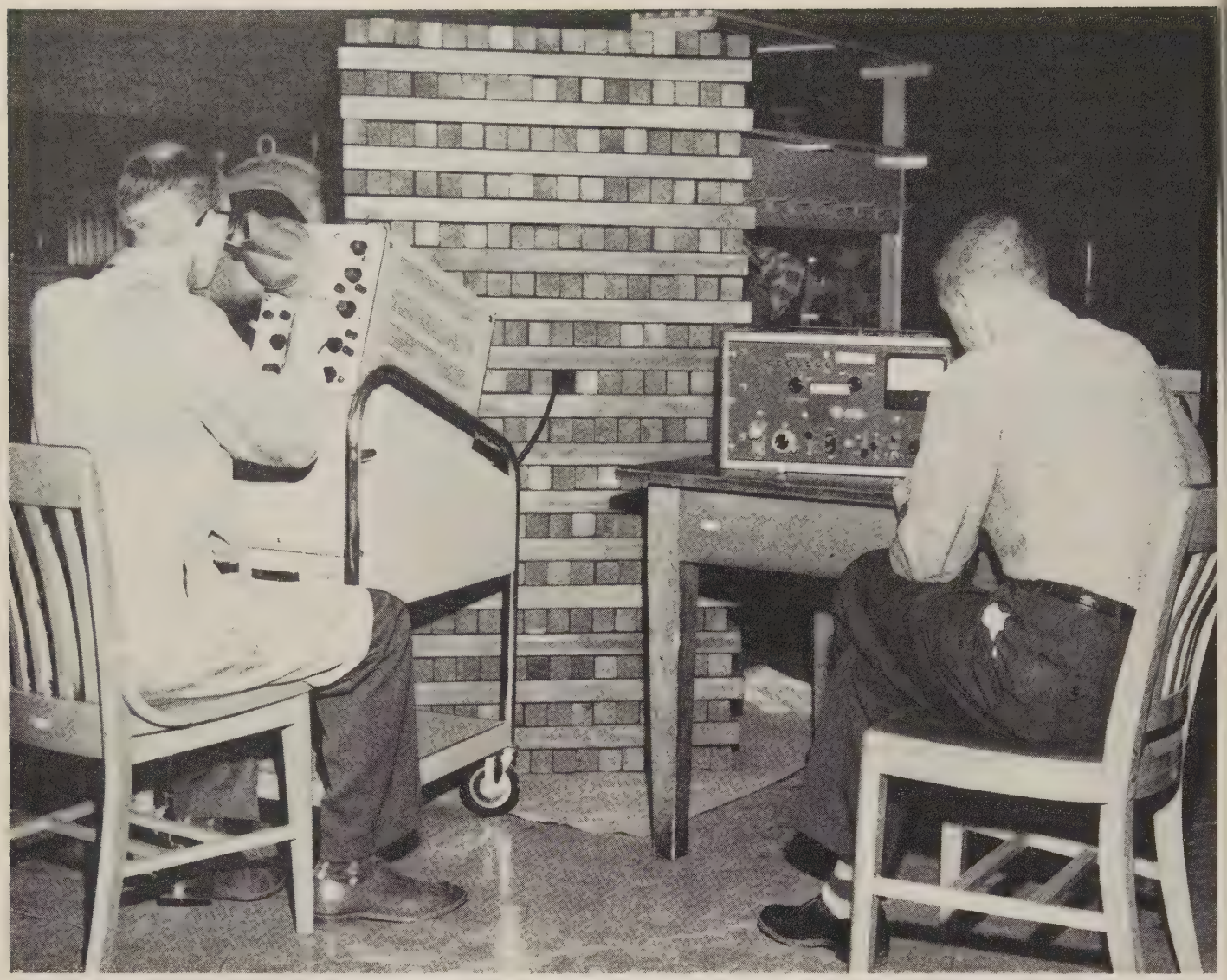
As a second alternative, the M.S. program can also be used to satisfy the minor field requirements for Ph.D. candidates in mechanical, metallurgical and electrical engineering, except for possible additional math requirements in electrical engineering.

Finally, a student may select a nuclear problem for his Ph.D. thesis topic. For the present, however, the Ph.D. Degree will be awarded after completion of the requirements in an appropriate established engineering curriculum. The desirability of this plan is obvious considering that thesis research in nuclear engineering is likely to fall into borderline areas requiring interdepartmental cooperation. A student also can take two or more units of nuclear engineering courses to satisfy the minor field requirements for an M.S. Degree in engineering.

The University has much equipment to aid graduate work in this field. The metallurgical facilities for the study of reactor material are an integral part of the nuclear engineering laboratory. The student has equipment available for the preparation of alloy melts, mechanical and heat treatment of alloys, and study of the variables relative to alloying and processing on the structure and properties of metals important to this field. A radio-chemistry laboratory is also at their disposal for the study of radio-active tracer techniques and the chemical processing of uranium or other radio-active solutions.

Heat transfer is a major problem in power reactor development. The University of Illinois Nuclear Engineering Program received a grant from the Atomic Energy Commission for the design and construction of a boiling water heat transfer loop. The loop is now under construction and will begin operation during the coming year. A second loop has been designed for the study of liquid metal heat transfer. These devices, currently under construction by Bei Toe

[1]Nov. Technograph—"Amps and Atoms=Plasma"



Prof. Wyman and J. F. Castro, a graduate student, are shown here operating a small sub-critical pile. Graphite for two such piles was donated by the Atomic Energy Commission.

Chao, Professor of Mechanical Engineering, will enable the students to simulate and study the behavior of heat removal in a nuclear reactor.

The Atomic Energy Commission will give the University of Illinois twelve and one-half tons of graphite, valued at $22,000, for the program. It was announced that the material, together with the graphite already owned by the University of Illinois will be used to construct two subcritical assemblies. These piles will contain natural uranium metal rods loaned by the A. E. C.

Although simulating reactors, the graphite piles will be too small to operate as active nuclear reactors. According to Felix T. Adler and Marvin E. Wyman, Professors in Physics and Nuclear Engineering, however, the subcritical assemblies will be important teaching tools. Through these devices the student will be able to perform experiments basic to reactor development and design.

The larger assembly, containing almost ten tons of graphite, will be used by students to study the behavior of neutrons in a uranium and graphite system. The smaller pile will be rebuilt frequently by the students in experiments with various fuel loading arrangements. When the two assemblies are operated there will be no danger to students or faculty. Safety precautions will be followed, however, on the rare occasions the radio-active sources are changed.

Just recently a $150,000 grant for construction of a training and research reactor at the University of Illinois was announced by the Atomic Energy Commission. It will be used for biological and agricultural research as well as engineering problems of importance to future power reactor development. Preliminary plans indicate the reactor will be the size of a large room and be two stories high. Part of it may be constructed underground. Its location will be just north of the new Physics Building. This reactor is the sixth project fo rwhich the A. E. C. has given the University aid.

For individual use, the University has excellent digital computing facilities in the high speed "Illiac." An I.B.M. 650 will be installed later this year. Of particular importance is the analogue computer recently redesigned so as to handle problems simulating reactor conditions, thus making possible direct solution of reactor kinetics and stability problems.

Lastly, the University is a participant in the nuclear technology program of the Argonne National Laboratory at Lemont, Illinois. This enables students to gain familiarity with operating reactors. Also it provides the possibility for summer employment.

The program is open to any B. S. graduate in engineering or science eligible for graduate study, and having a 3.75

(Continued on Page 38)

A LOOK INTO THE ENGINEERING FIELDS

Ready for airline service—High above coastal clouds, Lockheed's prop-jet Electra transport cruises in excess of 400 m.p.h. (650 km/hr.) in a preview of the jet age service it soon will offer air travelers.

AERONAUTICAL ENGINEERING

Do you remember that science fiction book you read just a few years ago, and the way it described satellites whizzing around the earth and the thunder of rockets rising from their launching pads? It sounds like standard procedure these days, and much of the credit for that is due to the field of Aeronautical Engineering.

Man has several satellites soaring around the earth, weighing from a few pounds to well over a ton. Commercial air travel has taken tremendous strides and jet transports are in service. The military has missiles of intermediate range and intercontinental capabilities. These missiles can cover these distances in minutes and hit a predetermined target.

From a crude beginning of observation and experimentation, Aeronautical engineering has developed into a highly complex combination of high-powered mathematics, physics, aerodynamics, and other related subjects.

Opportunities are available to students of varying interests. The fields of specialization range from design and testing to structures and maintenance.

Mathematics is one of the main tools of the Aeronautical engineer. Students who have difficulty with this subject should not plan to enter the field.

The first two years' curriculum for Aeronautical engineers is much the same as for the other engineering departments. Starting in the third year, subjects such as thermodynamics, dynamics, aerodynamics, vibration and flutter analysis, structures, metallurgy, electrical machinery, propulsion, design, and advanced mathematics are included in the Aero's schedule.

Armed with this knowledge, the engineer can answer questions such as: What forces act on an aircraft to keep it in flight? What types of structural members are necessary to resist various external loads imposed upon the aircraft while in flight and on the ground? How long can a given aircraft be expected to give satisfactory service? What material and human limitations must be placed upon an aircraft to insure safe and dependable flight?

These are but a few of the many questions, and the lives of many individuals may depend upon the decisions.

It is sometimes said that the Aero. E. is too specialized—that the only place he can work is in the aircraft industry. To some extent that is undoubtedly true, but the Aero. E. has a broad enough education that he is capable of doing work in many other fields. The Aero. E.'s training in light weight design may be applied to many fields from household equipment to building design. Above this, the aircraft industry is the largest in the country.

The wide range of aircraft designs gives the engineer an opportunity to select a place that interests him. He can work with small private planes, commercial airliners or jet transports. Military aircraft range from small supersonic carrier-based planes to large bombers and from the flying jeep to the missile. Comparatively new fields have recently opened up in space flight, satellite designs and atomic-powered aircraft.

With the coming of the space age, many new problems have developed. Accurately computing trajectories and the problem of re-entry are but a couple of the important developments. Aeronautical engineers are becoming increasingly concerned with the problems of flight in the outer regions of our atmosphere and in so-called "outer space in which the basic pirnciples of flight must be modified and, in some instances, completely changed.

And the student's reward after entering this challenging field? Well over half of his opportunities will be on the West Coast where he will receive probably $500-$600 per month as a starting wage. Beyond this are his future possibilities in a vital, growing industry; unprecedented new developments; a secure future; these are reasons to consider aeronautical engineering as a career.

AGRICULTURAL ENGINEERING

Are you interested in promoting a more prosperous agricultural economy? Are you interested in engineering principles? If so, then you would probably be interested in agricultural engineering. It involves the application of the basic principles of engineering to specific problems in agriculture.

As in any other division of engineering, Ag. engineers need a good background in engineering fundamentals. To obtain this background, all freshman engineers take the same courses. During your sophomore year, you would take several agriculture courses intended to acquaint you with the problems you will later face in your profession. In addition, you begin to take a few basic subjects in the field of agricultural engineering which show the application of engineering principles to these problems, as well as the standard courses in physics, calculus, and surveying.

The work becomes more advanced and subsequently more interesting in your junior year. You begin to think about which option you wish to major in. When one investigates the field of agricultural engineering, the first phase that becomes apparent is power and machinery. However, there are three additional options: farm structures, electrification and crop processing, and soil and water conservation. The option is chosen at this stage because you will take courses depending upon which you select.

In the senior year, in addition to more advanced material, you have an opportunity to apply your ingenuity and training to try solving some specific design problems. The class also goes on an inspection trip to see what practicing engineers are doing.

By now, it probably sounds like your education in agricultural engineering is pretty well cut and dried. This is quite the contrary. The curriculum contains certain courses besides the technical subjects which better prepare you to assume the responsibilities of your future profession. For instance, in the junior and senior years, there is space allotted for thirteen or more hours of social science or humanities electives, and more may be taken if desired.

Within your curriculum, though, what can you expect? In farm power and machinery, the objective is to assist the development of efficient and economical power and implements to aid the farmer in crop and livestock production. They design and develop it, demonstrate its use, and counsel its selection by farmers.

In the study of electrification and crop processing, two approaches are made. The first is concerned with putting electricity to work on farms. It is not the development of basic electrical devices, but the taking advantage of the flexibility, convenience, and automation afforded by electricity as applied to agricultural purposes. Crop processing considers the application of engineering methods and equipment to the design of cold storage and locker plants, abattoirs, creameries, and other processing plants.

Soil and water management is concerned with keeping the soil and water controlled and where they belong. It is applied to irrigation, drainage, and the control of soil erosion. Conservation calls for close co-operation with biochemists, agronomists, foresters, meteorologists; also with power and machinery engineers to devise machines and ways of tillage that resist the ravages of wind and water.

Upon completing this course of study, a graduate can qualify for various jobs, including:

1. Developing and testing new or improved equipment for tillage, harvesting, and processing crops and for saving labor on the farm.

2. Planning and layout of tile and open-ditch drainage systems, irrigation systems, terraces, strip cropping, grass waterway, and other soil conservation practices.

3. Design and construction of farm machinery, farm buildings, and electrical conveniences.

4. Promotion and sales of a variety of engineering equipment and materials used on the farms.

5. Management positions with large canning companies, rural electrification co-ops, and manufacturing companies.

6. Research work with new methods and equipment of saving labor, increasing crop yield and quality, and improving farm living.

These jobs, available all over the nation, are greatly rewarding to the agricultural engineer. Employment opportunities are ample, salaries are high, and the engineer may derive much satisfaction from performing an important service.

An analysis of a tractor is being run in the Engineering Experiment Station

A student is shown learning the fundamentals of machine drawing. This is one of the many skills a general engineer must acquire.

GENERAL ENGINEERING

Management; Sales; Journalism; Geology; those don't sound much like engineering programs—or do they? Industry today has noticed a lack, or even an aching void, of knowledge *relating* the two extremes of commerce and engineering. Engineers couldn't manage people, or money, or policies; only machines. Traditional-style managers got into technical departments, and didn't know what they were managing. Salesmen went out hopefully, only to find they didn't understand what they were selling, and so couldn't sell. Industry hired writers to prepare instruction and maintainance manuals and reports, only to find that the writers believed that *amps* were little black insects with six legs.

Sensing this wide, even dangerous gap, between engineering and the people handling its products, the College of Engineering established the school of General Engineering. On the technical side, the student has his choice of two general plans; structural design or machine design. There is little question of engineering competence involved, for in the mechanical option, the G.E. is missing only about one semester of more specialized courses taken by the regular mechanical engineer. The real strength of the curriculum, however, lies in the secondary option taken somewhat similar to a "minor" subject in Liberal Arts, as compared to the "major," engineering.

In the Management Option, the emphasis is upon controlling and co-ordinating, not only technical activities, but also non-technical and whole manufacturing divisions or concerns. Accounting, economics, finance, insurance, management, and administration are applied courses taken in this field. The graduates normally enter management training programs for large industrial concerns.

An additional opportunity is in the marketing field. Entering this interesting field, the student investigates salesmanship, advertising, accounting and marketing management, in addition to his engineering work. Graduates here may expect to enter one of many firms searching for salesmen, field engineers, application engineers, and industrial marketing specialists.

Those choosing Journalism study typography, illustrations, report preparation, writing, and publication. In a growing field, these men are responsible for installation and instruction, and repair manuals, industrial advertising, and technical writing. Able to handle technical subjects and make them understandable, these graduates have increasing application in our complex society.

Those students choosing geology work in soil mechanics, minerology, and related geological fields. Occupationally, they go into foundation construction, prospecting, earth moving, and similar subjects.

Although about one third of the companies interviewing at the placement office are interested in General Engineers, with the resulting good opportunities, rapid advancement, and rising salaries, the prospective G.E. should look at himself closely before entering the school.

Firstly, if his technical leanings and abilities are weak, G.E. will be every bit as hard as any other engineering course. It may even be more difficult, due to the numerous survey-type courses which cover amazing quantities of material in short times. This student would probably do better in Commerce, Journalism, or Liberal Arts.

THEORETICAL AND APPLIED MECHANICS

The Department of Theoretical and Applied Mechanics offers a four-year undergraduate program leading to the degree of Bachelor of Science in Engineering Mechanics. The curriculum is designed primarily for those interested in research and development careers in the field of engineering. Throughout the program, special emphasis is placed on mathematics and on fundamental principles. The courses are oriented for the student to obtain great depth of understanding of the basic sciences (mathematics, physics, chemistry) and the engineering sciences (mechanics of solids, fluid flow, thermodynamics, etc.) and to gain insight and skill in the application of these sciences to engineering problems.

In addition, nearly all undergraduate curricula in engineering require courses in statics and dynamics of rigid bodies, in strength of elastic and of inelastic materials, and in hydraulics and fluid mechanics offered by this department.

The laboratories of the Department of Theoretical and Applied Mechanics, except the car wheel and railroad research laboratories, are housed in the Arthur Newell Talbot Laboratory. An indication of the types of work conducted in the various laboratories follows.

In the materials laboratory the student makes use of various types of testing machines for determining the load-resisting properties of materials required in the design, construction, and operation of engineering machines and structures and for observing the deformations of members subjected to various types of loads. For research and advanced instruction in the behavior of large machine parts and structural members, testing machines with capacities as large as 600,000 and 3,000,000 pounds are available together with a wide selection of precise mechanical and electrical instruments for measuring the detailed strains in a member.

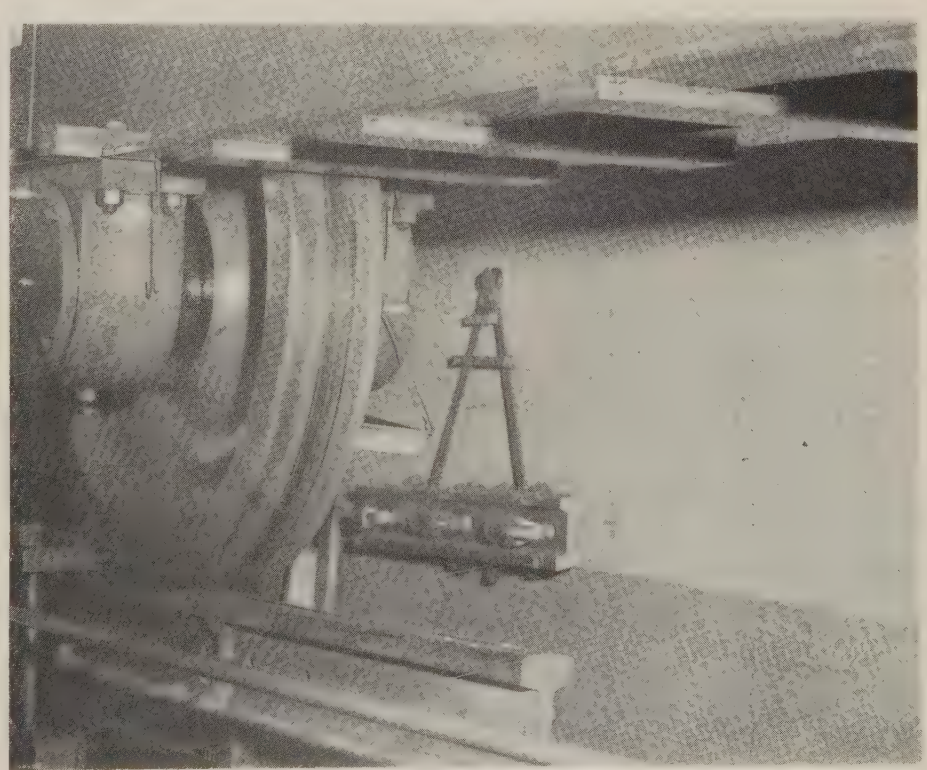
The concrete research laboratory has facilities for making, curing, and testing concrete and reinforced concrete members under repeated and impact loading as well as static loading.

The fatigue of metals laboratory contains many machines of unique types for studying the behavior of materials under repeated loading and under particular environmental conditions involving corrosion, high or low temperatures, etc. Facilities for determining the creep and relaxation of materials are also available for appraisal of the effect of time and temperature on the behavior of materials, with special reference to fatigue and elevated temperature service. A knowledge of the internal crystalline structure of metals is used in planning research and in analyzing the results.

The photoelasticity laboratory is equipped for the analysis of stresses in bodies of irregular or complicated form for which mathematical or theoretical methods are inadequate. Instrumentation is available for other techniques of experimental stress analysis involving optical and electrical as well as mechanical methods. The vibration laboratory employs various models and instruments, such as vibration excitors and oscillographs, for determining wave form, frequency, etc., of vibrations in machine parts and structural members.

The plastics laboratory, in which constant temperature and humidity are maintained, is equipped with a wide range of modern apparatus for the study of the load-resisting properties of plastics and plastic laminates.

The hydraulics and fluid mechanics laboratory contains equipment for the study of the flow of water in open channels, in pumps and turbines, and in various pipe systems. The flow of air and oil is also studied in several experiments. Some of the more important special instrumentation consists of several types of viscometers, transparent walled tilting flumes, an air tunnel, and a two-dimensional water tunnel. Facilities for research and graduate study are available in both open channel flow and closed conduit flow in maximum quantities of approximately 40 cu. ft./sec.



Shown here is the weld testing machine as used by the Theoretical and Applied Mechanics Department.

ELECTRICAL ENGINEERING

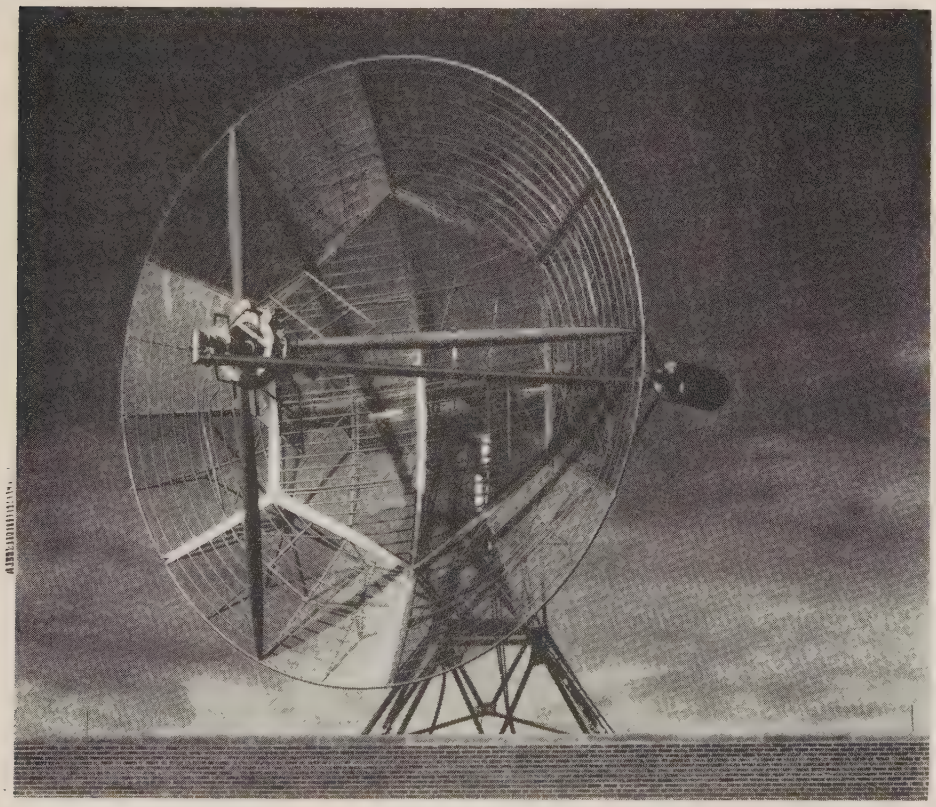
The electrical engineering curriculum prepares men for responsible engineering positions in research, development, design, operation, sales, and administration in the fields of electrical power, communications and electronic engineering, and illumination.

Fundamental to the curriculum is basic work in mathematics and physics which is taken by the student during his first two and one-half years. Work in the Electrical Engineering Department begins in the second semester of the second year with a basic course in electric circuits and fields. This course must be satisfactorily completed before any of the third-year work in the department may be undertaken. Transfer students who do not have the equivalent of this prerequisite course should consider the possibility of attendance during a summer session in order to take it. They will then be able to start the full junior program in the fall semester.

During the third year the student is expected to choose which of the subareas of the general electrical field he desires to emphasize. These sub-areas are represented by the electives in electrical power engineering, communication and electronic engineering, and illumination engineering.

The Electrical Engineering Building has laboratories which are well equipped for the experimental solution of problems in all fields of electrical engineering. Provision is also made for graduate work in these laboratories. Facilities are available for research in most areas of electrical engineering including vacuum and gas tubes, antennas and fields, ultrasonics, power generation, power transmission and distribution, and illumination.

For students who show exceptional ability and interest and who present an integrated program of study, opportunities to do individual work, particularly of an investigational nature, are provided in both the third and fourth years. Although the curriculum specifies the requirements for a degree, these students may pursue a program, if approved, fitted to their particular needs.



This structure on top of the Electrical Engineering Building receives radio waves from New Jersey via the moon.

THE DEPARTMENT OF MECHANICAL ENGINEERING

The courses in the Department of Mechanical Engineering present the theory and practice of the generation, transmission, and utilization of power; and of the theory of operation, design, testing, and construction of machines of all kinds. In the laboratories emphasis is given to the engineering and economic principles of machine operation, performance, and construction, and to the problems of production management.

The curriculum provides training in the basic courses of science, mathematics, design, power, production, and engineering fundamentals, with electives which the student may select during the junior and senior years, depending upon his interest in any of the heat-power, machine design, production, research, air conditioning, refrigeration, petroleum production, and railway motive power. These elective courses do not make a specialist of the student but rather give him a wider background and apply fundamentals previously learned to the field of his particular interest.

The laboratories of the department are provided with modern equipment for graduate investigations and research as well as undergraduate instruction. A brief listing of the laboratories indicates the breadth of the available facilities. The following laboratories are located in the Mechanical Engineering Building, the Mechanical Engineering Laboratory, and in the Foundry: power, physical environment, internal combustion engine and turbine, machine tool, metal cutting, welding, foundry, sand testing, heat treatment of metals, machine design, motion and time study, instrumentation and controls, heat transfer and combustion, thermo-dynamics, fuels and lubricants, gage calibration, tool design, and plant layout. Several of these laboratories contain special machines and equipment which make them outstanding in their respective fields. In addition, three research residences are owned, maintained, and operated by cooperation organizations for research in the general field of heating and ventilating.

If tests prove favorable, jet aircraft pilots who must abandon their planes will be shot out of the cockpit on a new rocket propelled ejection seat.

CIVIL ENGINEERING

How would you design an overpass on the new interstate highway? Could you supply all the water for the city of Chicago? How large should each beam be in a certain railway bridge? A civil engineer could do these things; would you like to?

Civil engineering has been practiced since the beginning of recorded history, but shows no sign of becoming stagnant. It is now sufficiently complicated that eight major fields are available to the graduate engineer, and there is no end in sight of the flood of new techniques or responsibilities.

Beginning with the common freshman engineering program, the student goes on, in his second year, to theoretical and applied mechanics, mathematics, physics, and surveying. His junior year is spent with more T. & A. M., and further courses in general civil engineering. Beginning his final year, however, the student may feel that he has entered some huge and fantastic highway interchange; which way should he go?

The "directions" for his fourth year include a great number of options, depending upon the choice of the student. As he chooses his field of specialization, so he chooses his courses.

Structural Design and Construction describes, and is the title of one option. The responsibility of this engineer is to design, construct, and maintain fixed structures, as opposed to machines, which are in motion. He will work with bridges, all sizes of buildings, dams, subways, and even aircraft. In this last field, the civil engineer applies his knowledge of complex structures to airframe design.

Surveying and Mapping is yet another field. While civil engineers are seldom involved with the average surveying crew, the precision work involved in tunnels, mines, railways, highways, and bridge piers needs expert supervision.

Further, over long distances, the curvature of the earth must be taken into account. This field, called geodesy, is dominated by the U. S. Coast and Geodetic Survey. Their maps are often accurate to one part in 3,000,000, and are of great value to other civil engineers.

The Railway Design, Construction, and Maintenance option is concerned with techniques and problems peculiar to the railroads of the nation. This includes track location and construction, signals, water supply, terminals, and structures. In this field, the University of Illinois is among the best to be found.

As the nation's population increases, it becomes practical to drain swamps and reclaim other lands. A drainage problem falls jointly to the Hydraulic Design engineers and Sanitary engineers. Those in hydraulic design are responsible for this, as well as irrigation, dam and canal design, and hydro-electric plants. Typical of projects involving hydraulic engineers are the Grand Coulee Dam and its water-powered generators, the Panama Canal, and the St. Lawrence Seaway, complete with locks, docks, canals, dredging, harbors and piers.

Sanitary engineering is a bit more specialized than the other options, requiring certain courses by the junior year. With the modern trend toward larger cities, improper water supply or sewage provisions can result in wholesale epidemics. In this curriculum, the biological, chemical and physical aspects are studied of water supply and treatment, sewage and industrial waste treatment and disposal, and stream pollution. The emphasis is on engineering problems involved in control of the environment to protect and improve health and comfort.

Within view now, in the huge interstate highway program, is an undertaking involving those students in Highway Planning, Design and Construction. The modern Highway Engineer must know how to locate, construct, and maintain roads and pavements. Drain-

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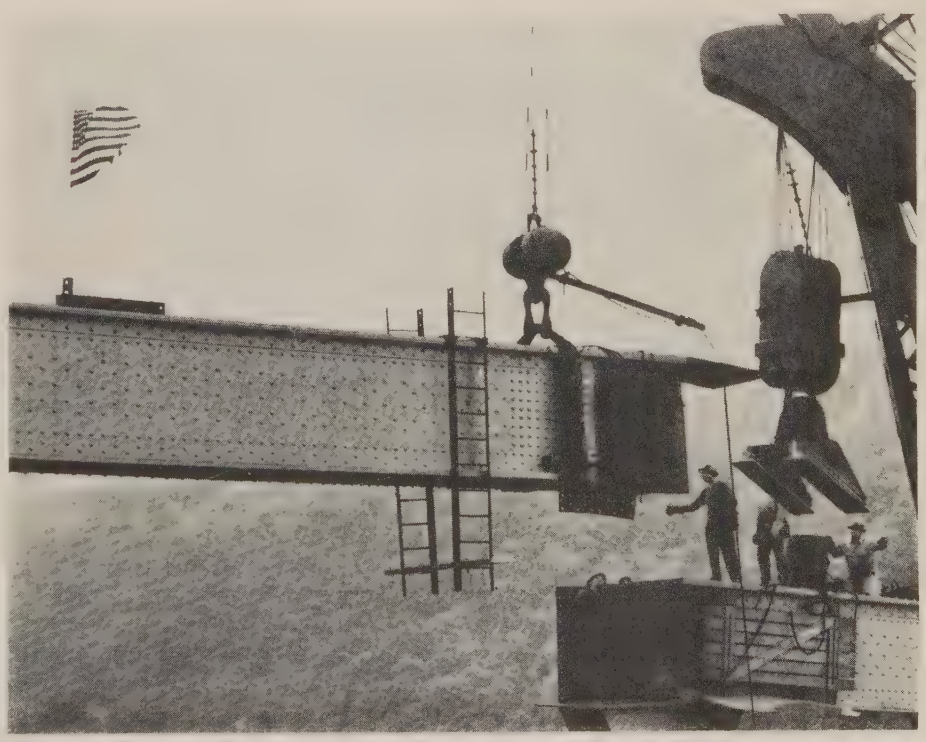
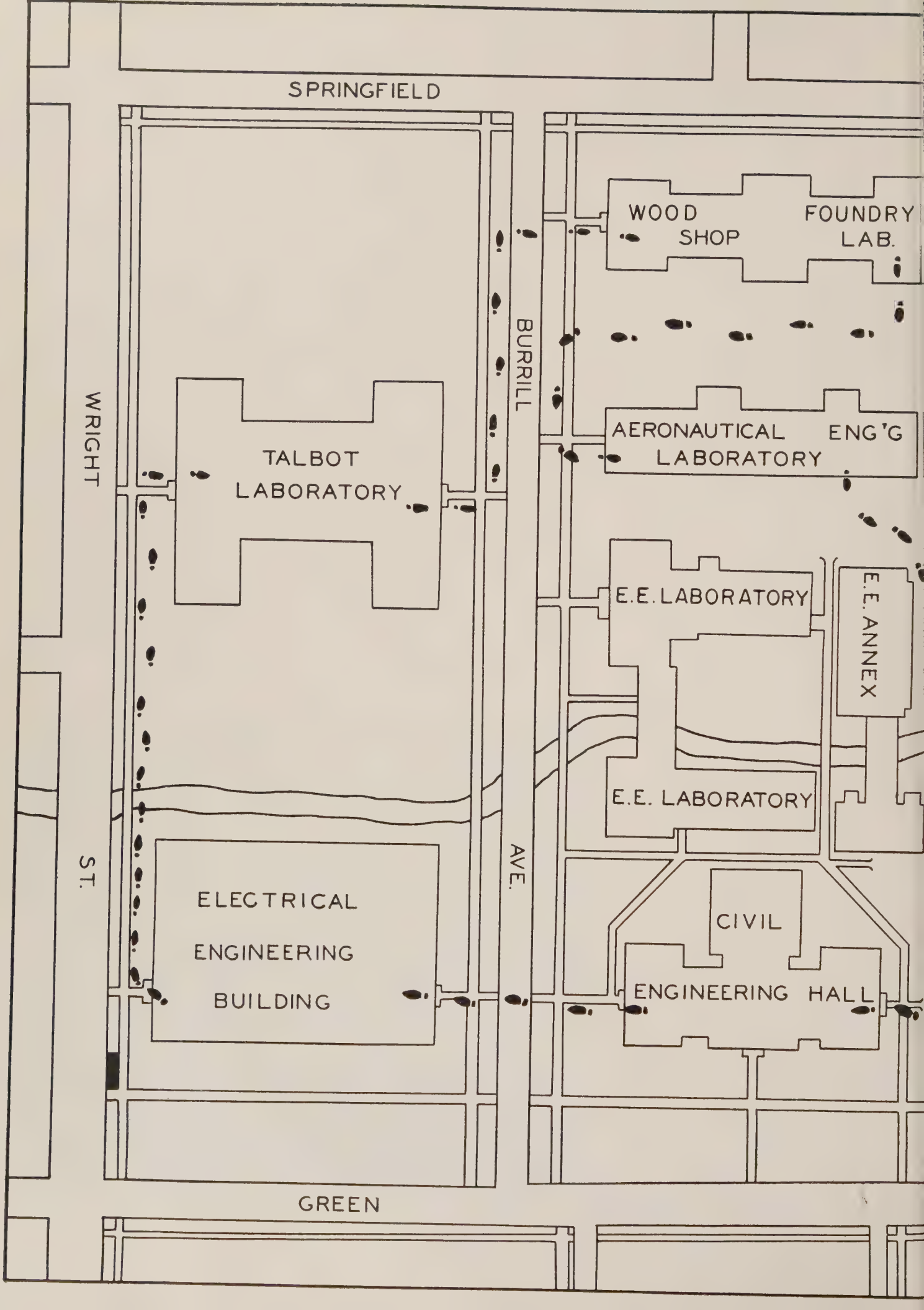


The American flag atop a 74-ton bridge section of high strength steel marks a festive moment in construction of the Fort Pitt bridge by structural ironworkers of U. S. Steel's American Bridge Division.


SPRINGFIELD
WOOD SHOP
FOUNDRY LAB.
BURRILL
WRIGHT
TALBOT LABORATORY
AERONAUTICAL ENG'G LABORATORY
E.E. LABORATORY
E.E. ANNEX
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ELECTRICAL ENGINEERING BUILDING
CIVIL ENGINEERING HALL
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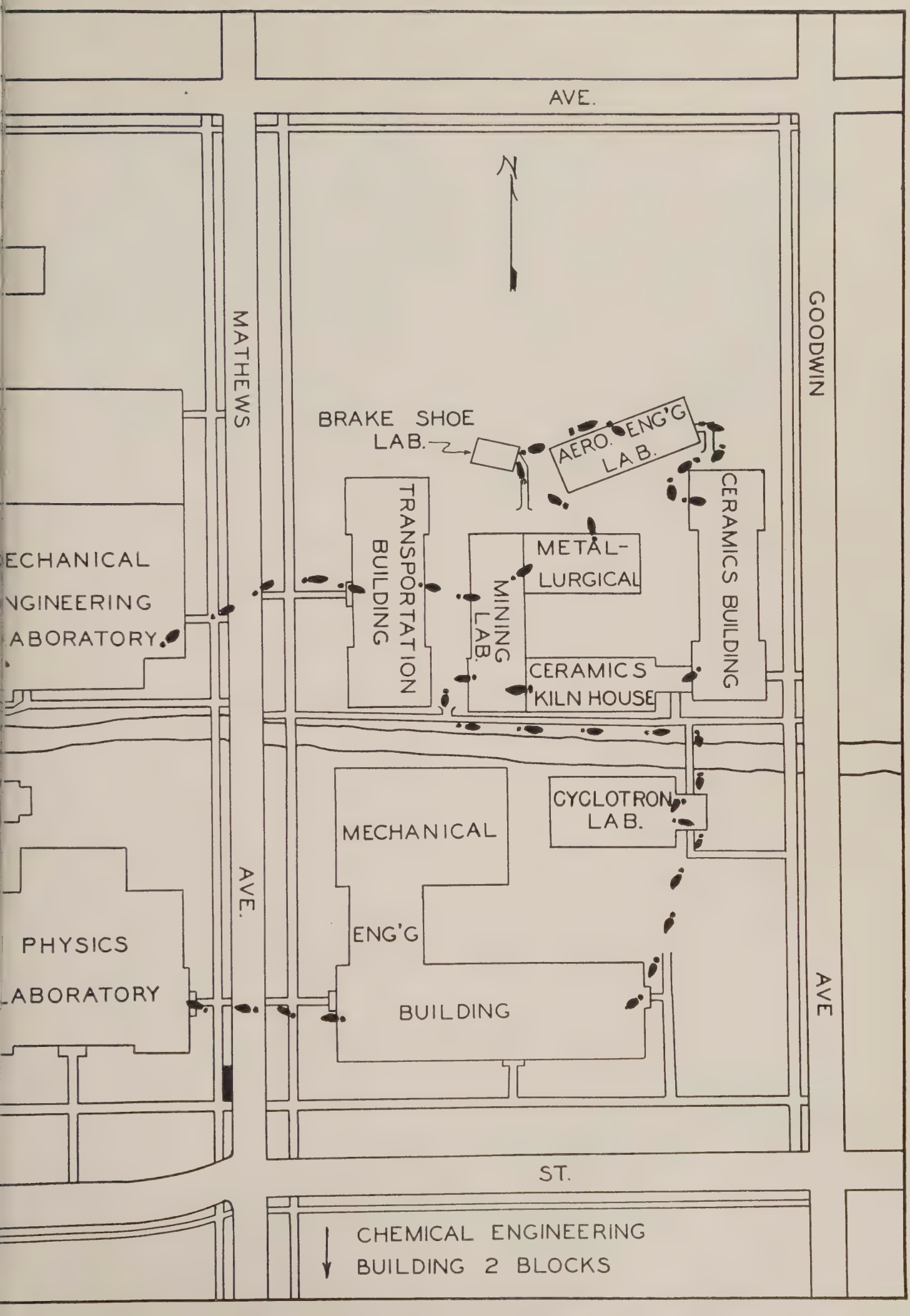
AVE.
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MATHEWS
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BRAKE SHOE LAB.
AERO. ENG'G LAB.
TRANSPORTATION BUILDING
MINING LAB.
METAL-LURGICAL
CERAMICS BUILDING
CERAMICS KILN HOUSE
ECHANICAL
NGINEERING
ABORATORY
CYCLOTRON LAB.
MECHANICAL
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BUILDING 2 BLOCKS

CERAMIC ENGINEERING

Are you interested in linings for rocket motors? Would you like to make a material hard enough to scratch a diamond? Could you compound a stronger concrete, or make a glass that will bounce? These and many other problems confront the ceramic engineer.

This department studies the scientific principles involved in manufacturing articles from generally non-metallic, inorganic materials. Originally dealing mainly with brick, tile, cement, pottery and glass, the field has mushroomed in recent years. Now studies are intense in the fields of porcelain enamels, abrasives, fiebrick and other refractories designed for terrific temperatures, such as in rocket motors and new industrial processes. A very new endeavor has been involving *cermets*, a mixture of ceramics and metals. Tough, hard, resistant to high temperatures and exceedingly corrosive materials, they promise great things in the field of turbine blades and similar critical spots.

Beginning with the common program for freshman engineers, the student goes in his second year into more math, chemistry, theoretical and applied mechanics, physics, and his first courses in minerology and ceramics. The junior and senior years deal more intensively with courses in the ceramic field, with choices of several technical and a number of social science and humanities electives.

This thorough training in engineering and the special field of ceramics prepares the student for many positions throughout the ceramic industry. Among these are control and supervision of processing and manufacturing, design of kilns, dryers and other equipment, research and development of new processes and materials, and in engineering service connected with the sale and usage of ceramic materials, products, or processing equipment. Some specialization is possible, utilizing the elective courses in the curriculum.

A large proportion of the students in this curriculum continue on into graduate school for the greater personal and financial reward involved. No matter what the degree, however, the graduate is sure to find a position to his liking, for the field is not crowded, and the University of Illinois is one of the finest of the few schools offering this course of study. Salaries and advancement are commensurate with the fact that the positions available far outnumber the graduates available, and personal satisfaction is great in this interesting and challenging field.

ARCHITECTURAL ENGINEERING

Architecture is defined as "the art or science of building." It is not only concerned with the technical subjects of engineering, but also with the fine arts. Engineering is an applied science, which involves the utilization of products of the earth for supplying human needs. Along this line, the supremacy of buildings over all the basic mechanisms of existence has never been doubted. Yet the rational thinking of an engineer is only half of the dual role of an architect, the other being the imaginative dreaming and sense of a creative artist. The objective of the student in architectural engineering is to discover and develop his inclinations towards each of these aspects.

The curriculum of architecture today covers a program as dual in nature as the role of the architect itself. The first two years deal mainly with forming a sound basic background in both engineering and design. At the end of the freshman year, a choice, again involving liberal or technical, confronts the student. If the engineering aspects of architecture are favored, the student may enter the architectural engineering program. This five year curriculum prepares you as well for contracting, sales, structural engineering, or any of the money fields closely related to architecture.

The five year architectural engineering program is the student's initial effort toward becoming a professional architect. Although here the heavier emphasis is on design, it involves learning and interrelating the techniques of engineering and art in such a way as to create an adept combination.

That the quality of the Architectural instruction is exceedingly high is quite easily proven. Year after year, in national competition between architectural students, those from the University of Illinois capture many high places, sometimes sweeping the awards completely.

Your choice of architecture as a profession is an especially timely one, for the architect is now confronted with bigger problems, and a greater challenge than ever before. The scope of his work has widened to include every aspect of our modern complex society, not only in the utilitarian sense, but in the sense of the creative artist. Because architecture sums up the civilization it enshrines, the field has become increasingly challenging—a job requiring a sound educational background and enthusiastic efforts.

CHEMICAL ENGINEERING

Fractionation, absorption, solvent extraction, catalyst; unfamiliar words, perhaps, but shared by chemists and chemical engineers. As they use the same terms, what are the differences between the two fields? The differences are largely in volume and application. The chemist is more likely to work in research to discover or perfect some material or process, while the chemical engineer will produce it in large, economical quantities or apply its use in the field.

The differences are more readily noted by examining the fields of study. Very similar for the first two years, the two curricula split at the junior and senior level, the chemist doing more basic work in analytic chemistry, with opportunities for specialization. The chemical engineer, meanwhile, is studying more general engineering courses, and chemical engineering projects, plant design, thermodynamics, unit operations, and general technology and applications.

There is a specialized option in chemical engineering called *bioengineering*, leading to greater proficiency in biochemical work. This course has emphasis upon the fields relating to pharmaceuticals, food processing, and biochemistry in general.

The graduate chemist will most likely be engaged in some form of basic research or product development, but it is not unusual in industry to find a chemist in chemical engineering position. Conversely, many chemical engineers may be found in the laboratory doing more basic work than is usual for their field.

In general, however the chemical engineer, relying on his basic work in chemistry, physics, math, and applied technology, will be found in process development or technical service. His work will include designing and improving large scale commercial plants, products, and equipment, operating or supervising commercial chemical processes, or applying the results of his company's work to the problems of the industrial customer.

Some latitude is allowed in arranging the curriculum, to better suit the courses taken to the specialized desires of the student, especially in chemistry. There the student may well decide to concentrate on the organic or inorganic field, according to the position he later wishes to fill.

Whatever his choice, however, the graduate may step readily into a large number of companies, many of which will be actively looking for a person of his qualifications.

Engineering careers all over the map!

Many young engineers who join Western Electric find themselves working not too far from home . . . for there are 22 Western Electric manufacturing plants across the country. But wherever these engineers are located, they share in exciting assignments that stem from our job as manufacturing and supply unit of the Bell System.

Since our work is geared to a continual demand for more and better telephone equipment, Western Electric engineers are constantly exploring relatively new technical fields. Some current examples: electronic switching, miniaturization, microwave radio relay, semiconductors, automation. They also pioneer in working with metals and alloys, raw materials, testing devices, chemical processes and the like.

Added to challenging assignments like these in production techniques and processes is our nation-wide distribution job. Here, engineers have key roles in devising systems for the supply and repair of telephone equipment. Elsewhere, telephone central office equipment is installed in thousands of cities and towns each year using tools, test sets and methods devised by Western Electric engineers. They also work with our purchasing people in buying the things needed by the Bell System. And they are responsible for engineering those defense projects assigned us by the government because of our specialized experience. Example: the U. S. Army's Nike guided missile systems.

To help our engineers keep abreast of technical advancements, we recently set up three special full-time, off-the-job study centers – in New York, Chicago and Winston-Salem, N. C. Here Western Electric engineers delve into such subjects as computers and semiconductors. This kind of training helps to insure professional growth.

What's the future for the management-minded Western Electric engineer? Consider these facts: 55% of the college graduates in our upper levels of management today have engineering degrees . . . in the next ten years some 7,000 key positions will have to be filled by newly promoted people, engineers included.

Western Electric technical fields include mechanical, electrical, chemical and civil engineering, plus the physical sciences. For more information pick up a copy of "Consider a Career at Western Electric" from your Placement Officer. Or write College Relations, Room 1111D, Western Electric Company, 195 Broadway, New York 7, New York. And be sure to sign up for a Western Electric interview when the Bell System Interviewing Team visits your campus.

Western Electric

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Principal manufacturing locations at Chicago, Ill.; Kearny, N. J.; Baltimore, Md.; Indianapolis, Ind.; Allentown and Laureldale, Pa.; Burlington, Greensboro and Winston-Salem, N. C.; Buffalo, N. Y.; North Andover, Mass.; Lincoln and Omaha, Neb.; Kansas City, Mo.; Columbus, Ohio; Oklahoma City, Okla., and Teletype Corporation, Chicago 14, Ill. and Little Rock, Ark. Also Western Electric Distribution Centers in 32 cities and Installation headquarters in 16 cities. General headquarters: 195 Broadway, New York 7, N. Y.

THE DEPARTMENT OF PHYSICS

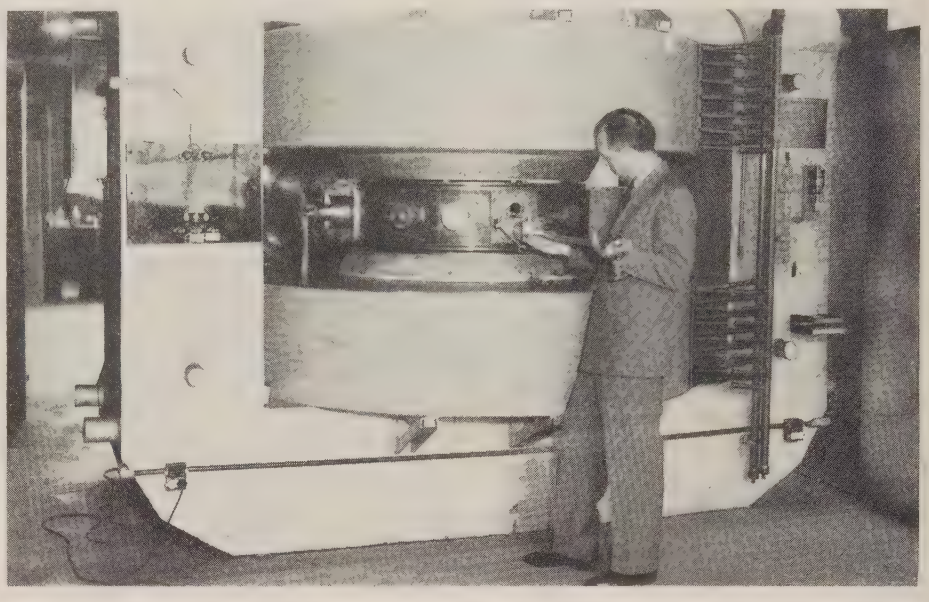
The Department of Physics offers a curriculum in engineering physics designed to give students the broad and thorough training in fundamental physics and practice. The work of the first two years is much like that in the other engineering curricula; in the last two years advanced courses in physics, mathematics, and chemistry are emphasized, but there is a liberal allowance of electives which the student may use to study the field of engineering in which he is especially interested. The details of technical applications are left to be learned in connection with a particular job; or, if the electives are properly selected, the engineering physics curriculum may be made a basis for graduate work in some particular field of engineering or in physics.

The Physics Laboratory has complete facilities for instruction and investigation in physics, and is especially well equipped for investigations in nuclear physics and physics of the solid state. An excellent library of periodicals and books of special use in connection with the courses in physics is maintained in the Physics Laboratory.

A cyclotron is housed in the Nuclear Radiation Laboratory and, with other experimental apparatus available there, is used by graduate students and faculty for experimental work in nuclear physics.

The betatron research and development program is housed in the Physics Research Laboratory. Faculty and graduate students are engaged in the study of nuclear phenomena produced by X-rays and electrons from the unique 340 M. E. V. betatron and the 22 M. E. V. betatrons.

The laboratory for the physics of solids has a cryostat for the production of liquid helium and a variety of apparatus for the study of metals, semiconductors, and other solids.



The cyclotron shown here is one example of the fine equipment available in the Physics Department.

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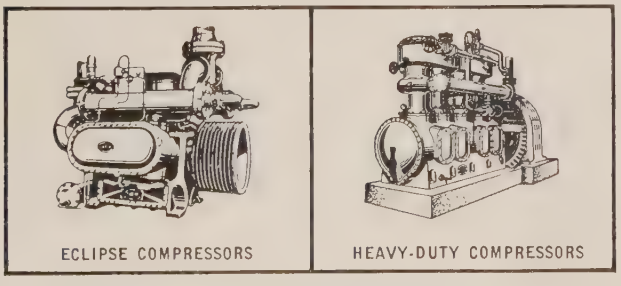

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Starting Salaries

The Engineers and Scientists of America have conducted a study of the trends in starting salaries of new graduate engineers. From the data available we have prepared recommended minimum starting salaries for various levels of experience and class standing.

Copies of this recommended minimum standard have been sent to your Dean of Engineering, Engineering Library, Placement Director, and Chairmen of the Student Chapters of the various Technical Societies.

We would be happy to send you a complimentary copy.

Engineers and Scientists of America
Munsey Building
Washington 4, D. C.

CIVIL ENGINEERING

(Continued from Page 23)

age must be figured, traffic interchanges designed, and the remolding of the earth by huge machines planned and directed. Proper construction must be planned for smoothness and durability of the roads. Our civilization today rolls on the projects of the higway engineer.

Though all of the specialists listed may design a project to fit some particular needs of man, and may well check the progress of construction, it is this translation of ideas to reality that concerns the engineer in Construction Planning, Methods, and Equipment. This man, a good civil engineer, must also be a hard headed businessman. He studies costs and estimates preparation, contracts, labor relations, and similar subjects, and handles such things on the job. Mechanically, he is responsible for the progress of the project, materials and machinery, and the general well-being of the construction.

For those who do not wish to specialize, there is also a General Option covering basic principles, design, and construction. No matter what his choice, however, the Civil Engineer may rest secure with his long background and far-stretching future of service to humanity.

NUCLER FUEL INOVATION

Two radically new approaches to the problems of high nuclear fuel, equipment and design costs, which has thus far prevented the atom from competing with conventional energy sources, were proposed recently by The Babcock & Wilcox Company.

The first concept introduces the use of mixed "light" and "heavy" water—or water of variable density—to control pressurized and boiling water reactors. This system would replace the costly and intricate control rod systems now widely employed. In addition, the company estimates that this new control method will "more than double" the useful life of a water reactor core and increase the efficiency of fuel consumption up to 30 per cent. Another advantage of the concept is that equipment costs can be reduced since it will be possible to extract up to 75 per cent more heat from a core of a given size.

To build a reactor core which will have a long life span, nuclear specialists explained, it must be loaded with considerably more fuel than is actually required to achieve a chain reaction. This extra fuel is then available to be "burned" to produce heat, power, or both. When burnup has reduced the amount of fuel in the core to the minimum required for a chain reaction, the core can no longer produce heat and must be replaced.

The fuel placed in the core for burnup, they stated, is used up less efficiently if control rods or other "nuclear poisons" are employed to counteract the "reactivity effects" of the extra fuel. The new method, they continued, provides a positive control medium which not only promises to achieve a low fuel burnup rate for the amount of heat produced, but also permits larger amounts of extra fuel to be added to nuclear cores. This makes possible a longer-burning and more efficient reactor fuel cycle.

As a result of the second research project, the company has developed a new high temperature reactor coolant consisting of fine particles of solids suspended in gas. The new low pressure coolant, engineers claim, "points the way to competitive nuclear power through remarkable reductions in both size and capital cost of major components of nuclear steam generating systems."

While results of these research projects have exceeded expectations, B&W reported, additional study will be required before the findings can be utilized in the production of power.

START TODAY TO PLAN TOMORROW

By knowing about some of the projects underway at the Babcock & Wilcox Company, an engineer may see his personal avenues of growth and advancement. For today B&W stands poised at a new era of expansion and development.

Here's an indication of what's going on at B&W, with the consequent opportunities that are opening up for engineers. The Boiler Division is building the world's largest steam generator. The Tubular Products Division recently introduced extruded seamless titanium tubing, one result of its metallurgical research. The Refractories Division developed the first refractory concrete that will withstand temperatures up to 3200 F. The Atomic Energy Division is under contract by the AEC to design and build the propulsion unit of the world's first nuclear-powered cargo vessel.

These are but a few of the projects — not in the planning stage, but in the actual design and manufacturing phases — upon which B&W engineers are now engaged. The continuing, integrated growth of the company offers engineers an assured future of leadership.

How is the company doing right now? Let's look at one line from the Annual Stockholders' Report.

CONSOLIDATED STATEMENT OF INCOME
(Statistics Section)
(in thousands of dollars)

1954	1955	1956—UNFILLED ORDERS (backlog)
$129,464	$213,456	$427,288

B&W engineers discuss developments in the Universal Pressure Boiler.

Ask your placement officer for a copy of "Opportunities with Babcock & Wilcox" when you arrange your interview with B&W representatives on your campus. Or write, The Babcock & Wilcox Company, Student Training Department, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

N-220

$ $ $

2-$25 Awards

Two cash awards of $25 each will be awarded to the author of the best TECHNOGRAPH staff article and the best non-staff article submitted to the ILLINOIS TECHNOGRAPH.

Rules:

1. Articles must be submitted by the author not later than April 1, 1959.
2. It must not have been previously published.
3. It must pertain to engineering in some way.
4. All articles must be doublespaced typewritten.
5. Technograph staff members are eligible for only one of the prizes.
6. Some articles will be printed in the TECHNOGRAPH.
7. None will be returned, but they will be kept on file and may be printed later.
8. Please include pictures, if possible, and permission for us to use them.
9. Any number of articles may be submitted by the same author.
10. The Technograph editorial staff will be judges for the non-staff articles.

Notes:

1. Ten typewritten pages with pictures makes three pages in the magazine.
2. Use rhetoric department punctuation and capitalization.
3. Many national companies will be glad to send you photographs and information.
4. Get started now and get several articles written and submitted by April 1, 1959.

$ $ $

Help Wanted!

Positions are available on the editorial and production staff of The Illinois Technograph. Experience of this type is invaluable for personal satisfaction, job references, and development of creative skills. Applicants need not be engineering students. Interested persons may call the editor, Dave Penniman, at 2-4254 or leave their name at The Technograph office in 215 Civil Engineering Hall.

A fellow driving his car with the top down was wearing a bright red shirt, a polka dot tie ,a shepherd's plaid suit, and a lavender beret. A motorcycle cop stopped him and made him pull over to the side of the road.

"What's wrong, officer?" asked the lead. "I haven't violated any traffic laws."

Said the cop, "I know. I just wanted to hear you talk."

* * *

The ship was sinking and the Captain called all hands aft. "Who among you can pray?" he asked. "I can," replied an Ensign. "Then pray, shipmate," ordered the Captain. "The rest of you put on the life jackets, we're one short."

* * *

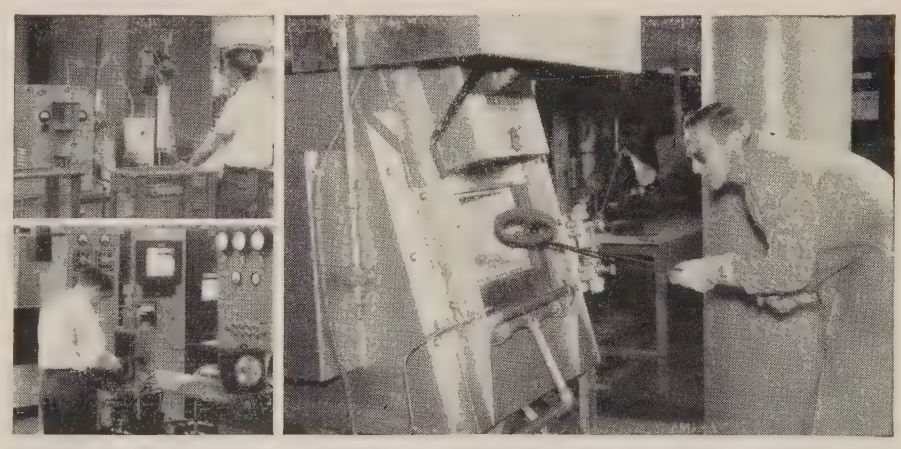
"He says I don't know how to dress, huh? Well, tonight I'll wear my low-cut dress and show him a thing or two."

* * *

A comely coed met her aunt downtown on Saturday night and was given her aunt's paycheck to take home. On the way home she was held up.

"Help, Help! I've been robbed!" she cried. "Someone has taken my aunt's pay!"

A policeman quieted her. "Cut out the pig Latin, girl, and tell me what happened."



LAB ANALYST (top) operates a carbon determinator for checking carbon content of bearing steel. Bottom, technician tests ball life with ball fatigue testing machine.

CONTROLLED ATMOSPHERE FURNACE used for determining heat treating specifications in Fafnir's metallurgical laboratory.

From Fafnir Research today, the bearings you need tomorrow!

Ball bearing requirements in many areas of industry are growing fantastically complex. Materials and lubricants used in bearings today are inadequate for certain foreseeable needs. To help find answers to such vital problems, engineers at The Fafnir Bearing Company are provided with the most up-to-date facilities for ball bearing research and development, including a completely modernized metallurgical laboratory, and highly refined devices for testing bearings, bearing materials, components, and lubricants. From such resources, and unceasing experiment, new and better Fafnir ball bearings are "born". That is why — when future progress reaches "turning points" — chances are Fafnir will have a bearing on it! The Fafnir Bearing Co., New Britain, Conn.

Write for booklet, "Fafnir Formula For Solving Bearing Problems" containing description of Fafnir engineering, research and development facilities.

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BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

Thousands of ITT engineers are "space men"

NOT *literally*, of course, but they are engaged in so many electronic activities associated with the vast air world above us that they might well be broadly identified as "space men."

Many have achieved a high record of success in research, design, production, testing, and field engineering of air navigation and traffic control systems . . . including ILS, Tacan, Vortac, Data Link, VOR, DME, Navascreen, Navarho, and automatic "typewriters" serving the Narcast system for in-flight weather reporting.

Other ITT "space men" are making important contributions to air reconnaissance, inertial navigation, infrared, missile guidance and control, electronic countermeasures, radio communications, radar, scatter communications, and other categories vital to national defense.

These are only a few of the many activities at ITT laboratory and production centers – coast to coast – where challenging problems are constantly opening the way to top careers.

Consult your College Placement Officer for interview date, or write to ITT Technical Placement Office, 67 Broad Street, New York 4, New York.

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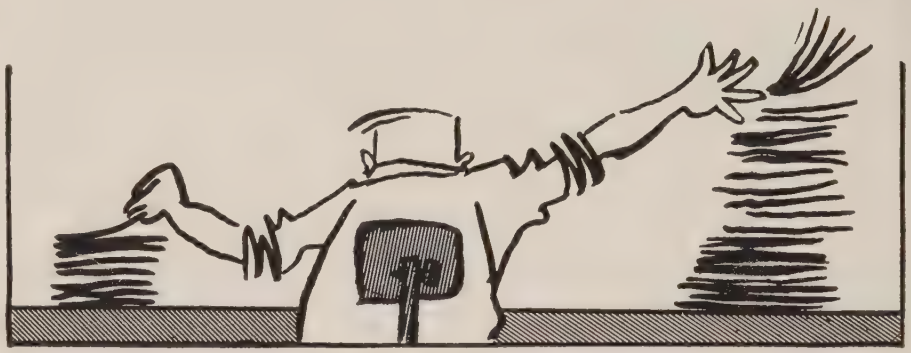


Edited by The Staff

Light-Producing Panels

Electroluminescent lighting panels for commercial applications announced by the Westinghouse lamp division will be available as rectangular "plates" in standard sizes ranging from 2x2 inches to 24x24 inches and in standard colors of green, blue or yellow.

Basically, the new Rayescent lamps consist of a sheet of glass coated with a phosphor layer and an electrically conductive coating. When voltage is applied, light produced by the phosphor is emitted from the transparent front surface. As man's newest light source, the lamps use no filaments, contain no gas or metallic vapor, produce practically no heat, and require only neglible electric current. They produce a completely diffused light without special fixtures or baffles.

Service life of the new units is conservatively rated as 5000 hours; tests now in progress indicate that much longer life can be expected. Power requirements of the new lamps are extremely low: For example, a 4x4-inch lamp supplied from a 120-volt, 60-cycle source draws only 0.07 watt.

The lamps can be operated at higher voltages through use of a conventional transformer of adequate rating; for operation at higher frequencies almost any oscillator or frequency converter of suitable frequency can be used so long as its output wave is essentially sinusoidal and lamp voltage ratings are not exceeded. Power supplies for 400-cycle operation will be available from Westinghouse in several ratings.

The thin, flat shape of Rayescent lamps makes them ideally suited for many difficult and unorthodox lighting applications: They can be made in special sizes and shapes up to a present maximum of 24 inches square, and legends or markings may be silk screened on the glass before processing. Lamps may also be made with surface segments that can be lighted independently of other segments, or in irregular shapes with holes or openings restricted only by the limitations of glass working techniques. Applications already in prospect for the new Rayescent lamps include elevator signals, lighted shelves, luminous baseboards, decorative lighting, signs, switchplates, darkroom lights, safety lights, thermometers, clock and radio faces, instrument faces, and automotive interior lighting.

Better Buick Bumpers

In order to provide the highest quality corrosion-resistant surfaces in the automotive industry, the Buick Motor Division has increased the minimum nickel thickness on the plated parts of the 1959 models by 60 per cent. This extra-thick layer of corrosion-resistant nickel provides a smooth, bright metal foundation for the brilliant chromium finish on such parts of the 1959 Buicks as the bumpers, headlight and tail light rims, door handles and grill components.

Owners of the new Buicks cannot see the additional nickel in their trim because it has been electrolytically deposited on a basis metal and then coated

with a thin layer of bright chromium. In the case of the bumpers, the basis metal is carbon steel which provides the necessary strength for this rugged application, with the nickel giving the steel protection from corrosion by deicing salts, exhaust fumes, etc. The thicker nickel plating also assures lasting beauty by protecting the plated parts against gravel nicks and bumps and scrapes incurred in parking and heavy traffic—making it easier for Buick owners to keep their new car trim showroom bright with a minimum of maintenance.

Metal-Ceramic Receiving Tube

Use of a General Electric metal-ceramic type 7077 receiving tube as a transmitting tube in the Army's 66,000-mile Juno II moonshoot December 14 permitted a much higher degree of tracking accuracy, reports James W. Rush, Jr., tube application engineering consultant of the company's receiving tube department.

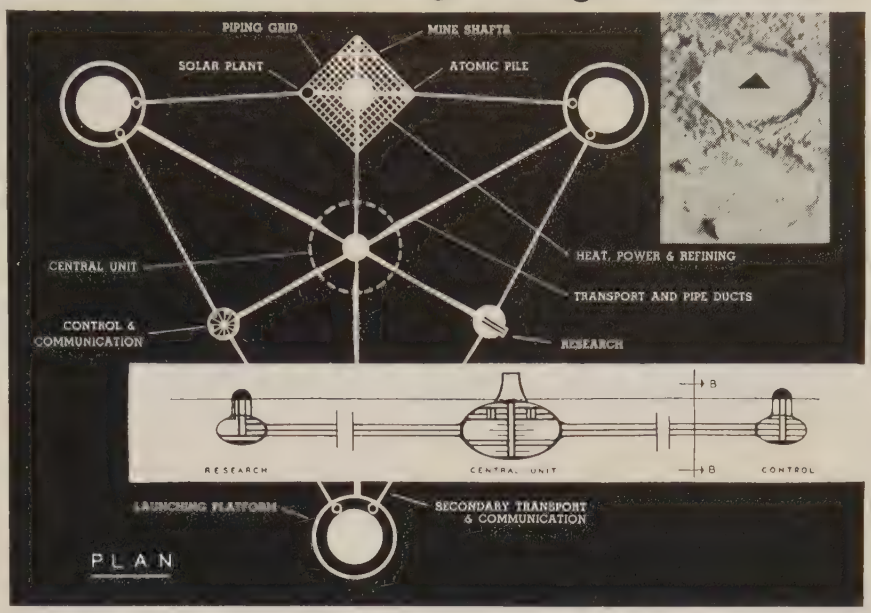
This new tube, half-inch long and half-inch in diameter, enabled a transmitting output of about 200 milliwatts at the frequency of 960.05 megacycles. The higher frequency brought greater tracking accuracy than the previously-used 108 megacycle channels because of reduced refraction and reflection by the ionized layers surrounding the earth and by permitting use of a sharper tracking beam. The tube was used by Cal-Tech Jet Propulsion Laboratory, Pasadena, in their space-borne transmitter. Rush said that for this project G. E. supplied JPL, at the normal manufacturers' price, with standard production tubes which had undergone special evaluation for this "out-of-spec" transmitting service.

The tubes give a 20-to-1 power gain in the class B amplifier circuit used. This 13 decibel gain amplified an approximately 10-milliwatt output of a transistor oscillator up to a usable 200-milliwatt signal, and enabled the use of a higher frequency tracking system.

While transistor transmitters on the Vanguard 108-megacycle frequency previously have been able to attain usable outputs, this lower frequency has left much to be desired for tracking purposes. The "transistor-sized" metal-ceramic 7077 tube, on the other hand, will enable pint-sized transmitters to put out a usable signal in the kilo-megacycle region.

It is believed that the power supply used with this tube was designed to last for several days. Rush said it is conceivable that new concepts in power supplies and advances in tube design and technologies will permit future transmitters to operate for longer periods.

MARS outstanding design **SERIES**



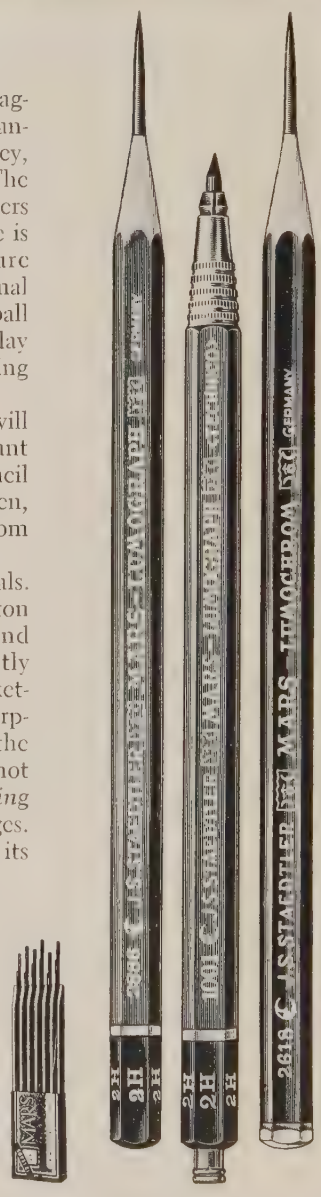
SCALE OF PLAN: 1″ = 500 FT.

lunar base

Tomorrow's realities depend on research and imagination today. Both were used extensively in the planning of this lunar base designed by William G. Harvey, Jr. to accommodate space ships and travelers. The suggested location is "Aristotle," one of the craters near the north pole of the moon. Most of the base is beneath ground level to minimize temperature changes. Living quarters are spacious and recreational facilities include a swimming pool and basketball court. Power is supplied by solar plants during the day and atomic pile at night. Research, living and working areas are joined by monorail subway.

No one can be sure which of today's new ideas will become reality tomorrow. But it will be important then, as it is now, to use the best of tools when pencil and paper translate a dream into a project. And then, as now, there will be no finer tool than Mars—from sketch to working drawing.

Mars has long been the standard of professionals. To the famous line of Mars-Technico push-button holders and leads, Mars-Lumograph pencils, and Tradition-Aquarell painting pencils, have recently been added these new products: the Mars Pocket-Technico for field use; the efficient Mars lead sharpener and "Draftsman's" Pencil Sharpener with the adjustable point-length feature; and—last but not least—the Mars-Lumochrom, the new colored *drafting* pencil which offers revolutionary drafting advantages. The fact that it blueprints perfectly is just one of its many important features.



The 2886 Mars-Lumograph drawing pencil, 19 degrees, EXEXB to 9H. The 1001 Mars-Technico push-button lead holder. 1904 Mars-Lumograph imported leads, 18 degrees, EXB to 9H. Mars-Lumochrom colored *drafting* pencil, 24 colors.

J.S. STAEDTLER, INC.
HACKENSACK, NEW JERSEY

at all good engineering and drawing material suppliers

Technocutie . . .

(Photos by George Knoblock)

GAY GRENLUND

Gay Greenlund, the pretty Miss shown on these pages, hails from Belvidere, Illinois. A member of Sigma Kappa sorority, she is a freshman in Elementary Education.

Her tastes include semi-classical music, though she admits being partial to Rock-andRoll at times. Gay likes to water-ski and play tennis during the summer, but as for indoor sports she likes volley ball, (Co-rec, no doubt!)

For those who think that good things come in small packages, Gay proves them right. She is 5 feet tall and weighs 100 pounds. Her critical diameters are 10.8"-7.0" - 10.8". To the slide rules, men!

Gay was chosen Junior I. F. Ball Queen this past semester, and rightfully so, we would say. The best part is, she is not yet pinned, engaged, or otherwise attached.

NUCLEAR ENGINEERING PROGRAM

(Continued from Page 16)

out of 5.00 or its equivalent. The undergraduate should select his courses so as to include the following:

Mathematics:

Advanced Calculus (3 hours)	Math 343
Differential Equations (3 hours)	Math 345

Physics:

Atomic Physics (3 hours)	
Nuclear Physics (3 hours)	Physics 282 or 382

Also desirable is an undergraduate course in thermodynamics or heat transfer, and one in physical metallurgy or solid state physics. Graduate students may enter the program before they have completed the pre-requisite courses. They should allow for an additional semester, however.

To obtain the M. S. Degree in Nuclear Engineering a student must complete eight units of graduate courses as defined below, including one unit of M.S. thesis study, or nine units without a thesis. This does not include courses specified as pre-requisites. At least four of the graduate units must be in Nuclear Engineering courses. The remaining units may be in related fields such as metallurgy, heat transfer, and others. Courses submitted for the M. S. Degree should be well balanced and must be approved by a program advisor.

A prospectice graduate student should submit his application for admission at least six weeks before he plans to register. Admission forms and the Graduate College Catalogue are available at 100a Administration Building. Foreign students should request admission by writing t the Dean of Admissions and Records. A student whose na tive tongue is not English must take an English examinatio before registering.

As far as financial aid is concerned, there are man sources of support for the interested student. First, the Uni versity is an approved institution for the Atomic Energy Commission Nuclear Technology and National Science Foundation fellowship programs.

Also, the University of Illinois Graduate College offers fellowships requiring no service which run $1500 tax free plus exemption from tuition and fees. These fellowships are awarded on a merit basis among all departments.

Finally, part-time research and teaching assistantships starting at $1900 for the academic year are available. These also exempt holders from tuition and fees.

This, then, is what the University has to offer in the field of nuclear engineering. If further information is required, the following sources will be of aid.

General Information:

University of Illinois Graduate College Catalogue

Technical Aspects of the Program:

Professor F. T. Adler Room 226, M.E.B. Ext. 3765

Professor M. E. Wyman Room 25 M.E.B. Ext. 3551

Financial Aid:

R. J. Martin, Director of the Engineering Experiment Station Room 106 C.E.H.

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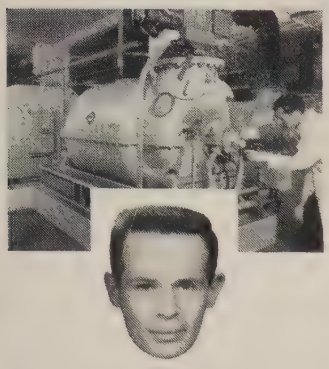
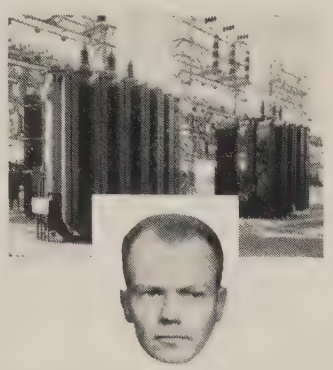
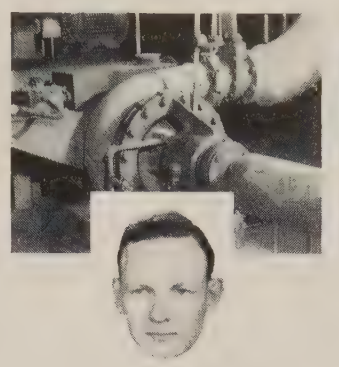
Allis-Chalmers training course has



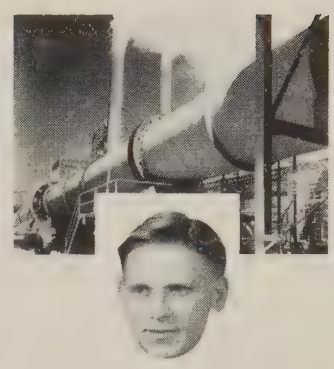
Aeronautical engineer Robert Claude, Parks College of Aero Technology, BS Aero Eng. '50, engineers compressors for wind tunnels.



Application engineering on large power transformers is handled by Michael Waterman, Case Institute of Technology, BSEE, '47.



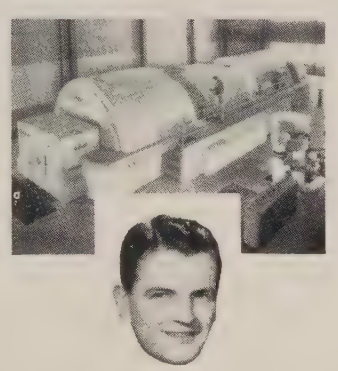
Sale of large centrifugal pumps to a wide range of industries is directed by Howard Godfrey, Oregon State College, ME '48.



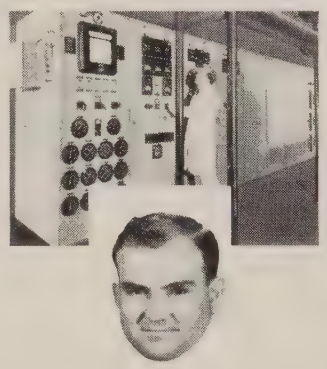
Field sales of America's widest range of industrial equipment is choice of Michael A. Mooney, University College, Dublin, BSE '53.

proved excellent springboard to

Sales and promotion man Irving Fisk, Clarkson College, EE '52, works with large power circuit breaking equipment.



Sales manager of large steam turbine generator units is interesting specialty of John M. Crawford, Clemson College, BME '49.



Sales engineering of high voltage electrical control is specialty of Ernest Horne, graduate of Alabama Polytechnic Institute, EE '49.

Nuclear engineer Raymond W. Klecker, University of Southern California, EE '49, is supervisor of design of nuclear reactors.

interesting and varied careers

YOU get off to the right start in your career at Allis-Chalmers—even though, at graduation time, you may not know exactly what you want to do.

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The course, incidentally, was started in 1904, and most of the A-C management team are graduates of it.

Your choice includes research, design, manufacturing, application and sales of hundreds of products in practically every industry . . . a wide range of fields from nucleonics to electronics to stress analysis.

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A-5601

Professors Robert McCloy (left) and S. M. Yen, researchers in aeronautical engineering at the University of Illinois, test their turbine model based on the principles of inventor Nikola Tesla.

Telsa Turbine Renovated

A University of Illinois professor of aeronautical engineering is developing what may be the world's most powerful turbine engine per weight.

Professor Robert W. McCloy has resurrected the Tesla Turbine, the 50-year-old idea of an "inventive genius," Nikola Tesla. Because the rotary action of steam, gas, or other fluids is imparted to the discs by friction the Tesla Turbine is unique in its method of removing energy from the fluid.

Nikola Tesla was an Austro-Hungarian born inventor and electrical engineer who came to the United States in 1884 to work with Thomas Edison. Best known as the father of the alternating current electrical system, he was also responsible for a host of other inventions and developments in the electrical field.

In 1956, after the idea of the Tesla Turbine had remained generally forgotten for 40 years, a student showed Professor McCloy an article in a "hot rod" magazine discussing the possible use of the turbine in sports cars. McCloy foresaw the application of Tesla's idea to small, highly powerful engines for light aircraft.

In unsponsored research since then, McCloy and Stansislaus Kwok-Pong Young, a graduate student, developed a theory for the rotary turbine, elucidating several of Tesla's original points. With other aeronautical engineering students, McCloy constructed a working turbine to test the theories and is now planning an advanced model.

McCloy's first turbine, which develops 45 HP at 10,000 rpm uses a gas jet as the source of power. Directed against the outer edges of a series of discs attached to a spindel, the gas follows a spiral path between the discs and leaves them at the inner edges.

Tesla's first turbine, built in 1906, weighed less than ten pounds and produced 30 horsepower or 3 horsepower per pound—the world's most powerful engine per pound. But because of differences with commercial firms in the construction of practical models, Tesla dropped his turbine experiments after 1911 to work with other projects.

The inventor was a visionary who foresaw the tremendous possibilities of electrical energy. Since he could visualize experiments in his mind, many of his ideas were lost with his death in 1943.

Although Tesla was interested only in developmental work and not in commercial applications of his developments, he did receive $1 million from George Westinghouse for patent right to his alternating current system. Other Tesla inventions and developments included neon-tube lighting, incadescent lighting, and remote radio controls.

from Deep space to Ocean floor

Vought offers this range to the young engineer

At Chance Vought the engineer's assignments range from the depths of the ocean to the farthest reaches of space . . . from hardware operating aboard the Navy's nuclear-armed submarines to space research vehicles still on the boards.

Here the engineer contributes to projects such as the record-smashing *Crusader* jet fighter series . . . the *Regulus* missiles . . . and advanced weapons, details of which are still classified.

Under the guidance of the Vought engineer, such weapons take shape. He supervises critical tests, and he introduces the weapons to the men with whom they will serve.

Engineers with many specialties share these experiences. Today, for example, Vought is at work on important projects involving:

SPACECRAFT AND ASTRONAUTICS
ADVANCED PROPULSION METHODS
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Vought's excellent R&D facilities help the engineer through unexplored areas. And by teaming up with other specialists against mutual challenges, the Vought engineer learns new fields while advancing in his own.

Would you like to know what men with *your* training are doing at Vought . . . what *you* can expect of a Vought career?

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Or write directly to:

C. A. Besio
Supervisor, Engineering Personnel
Dept. CM-11

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

Vought Vocabulary

space′craft: *a weapons field wide open to young engineers at Vought*

Here, your "feel" for space will come quickly. Vought's core of seasoned space specialists is introducing the new medium to a widening circle of colleagues. The goal is space indoctrination for all engineers – a space capability comparable to Vought's current stature in missiles and aircraft.

With experience, the young engineer will join Vought projects under way this minute: space research vehicles; cockpits and crew quarters for space; devices for escape from orbit; nuclear and ionic propulsion.

In astronautics, as in *Crusader III* fighter and *Regulus II* missile development, the Vought engineer's view will be broad. He will conceive, develop, design and test complete products. This is an advantage found only in a company that holds both weapon system management and detail design responsibility.

CHANCE VOUGHT AIRCRAFT
INCORPORATED DALLAS, TEXAS

ChanceVought's Regulus II. Nuclear-armed, long-range missile. First supersonic missile ever successfully launched from a submarine.

EENY

MEENY MINY

MO

Industry's demand for capable graduates in the fields of science and engineering is still exceeding the supply produced by American colleges and universities. As a result, the most promising members of this year's class may well wind up with a *number* of openings to consider.

In such circumstances, who would blame a bright young man for at least letting the phrase "eeny, meeny, miny, mo" slip through his mind!

Of course, there is one inescapable conclusion to be considered: openings are one thing, genuine opportunities quite another. Thoughtful examination of such factors as potential growth, challenge, advancement policy, facilities, degree of self-direction, permanence, and benefits often indicates that real opportunity does not yet grow on trees.

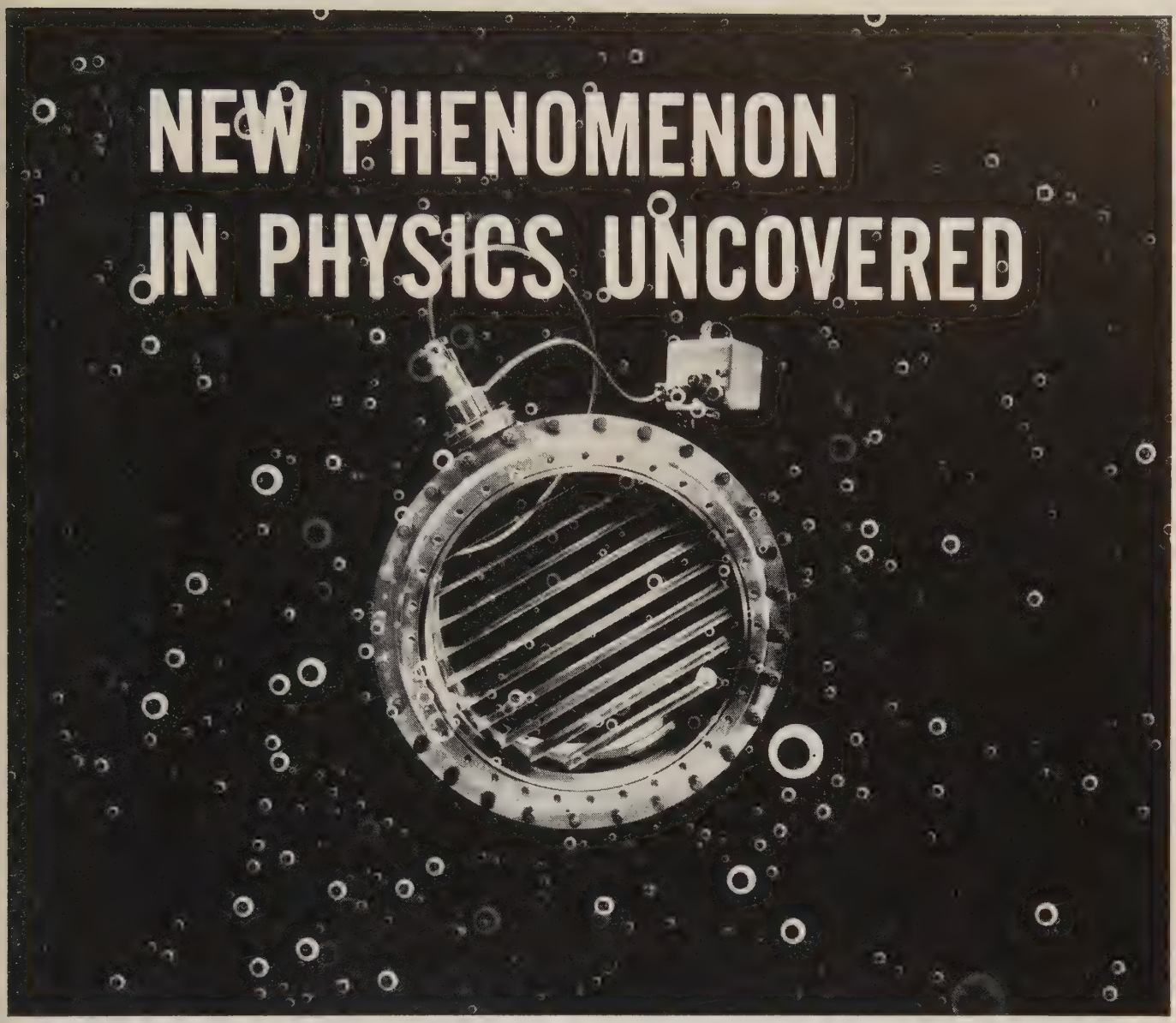
Moreover, the great majority of personal success stories are still being written by those who win positions with the most successful companies.

For factual and detailed information about careers with the world's pioneer helicopter manufacturer, please write to Mr. Richard L. Auten, Personnel Department.

SIKORSKY AIRCRAFT

One of the Divisions of United Aircraft Corporation

Bridgeport-Stratford, Connecticut



Investigation in detecting cavitation, or forming of vapor bubbles in liquid flow, led AiResearch engineers to the discovery of an important new phenomenon . . . *that flow of bubbles in liquids generates a magnetic field.* This discovery, among other things, helps solve critical flow problems in missile and industrial fields. The AiResearch cavitation detector pictured picks up these tell-tale signals as the liquid passes through the grid, pinpointing the cause of trouble.

Many such pioneering developments are underway in challenging, important work at AiResearch in missile, electronic, nuclear, aircraft and industrial fields.

Specific opportunities exist in system electronics and servo control units; computers and flight instruments; missile auxiliary power units; gas turbine engines, turbine and air motors; cryogenic and nuclear systems; pneumatic valves; industrial turbochargers; air conditioning and pressurization; and heat transfer, including electronic cooling.

ENGINEERING AT GARRETT OFFERS YOU THESE ADVANTAGES:

- **Intensified engineering is conducted by small groups where individual effort and accomplishment is quickly recognized providing opportunity for rapid growth and advancement.**
- **An eight-month orientation program is offered prior to permanent assignment to help you aid us in determining your placement from a variety of analytical or development projects.**
- **Advanced education is available through company financial assistance at nearby universities.**

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GROOMING ELECTRONICS

FOR THE SPACE AGE

Systems in the Air

The march of electronics into the Space Age is being quickened as a result of Hughes work in airborne electronics systems.

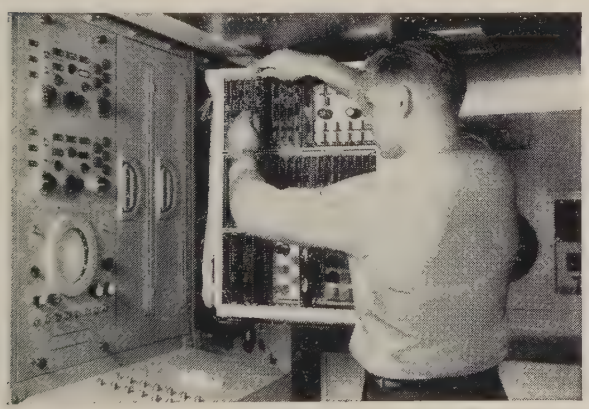
One such development is the Hughes Electronic Armament System, which pilots high-speed jet interceptors to enemy targets, launching Hughes air-to-air guided missiles, and flies the plane home. Even more sophisticated Electronic Armament Systems completely outstrip those presently released for publication.

Working on space satellites, Hughes engineers are active in the preliminary design of guidance and control systems, communication and telemetry systems, sensing devices using infrared, optical and radar techniques.

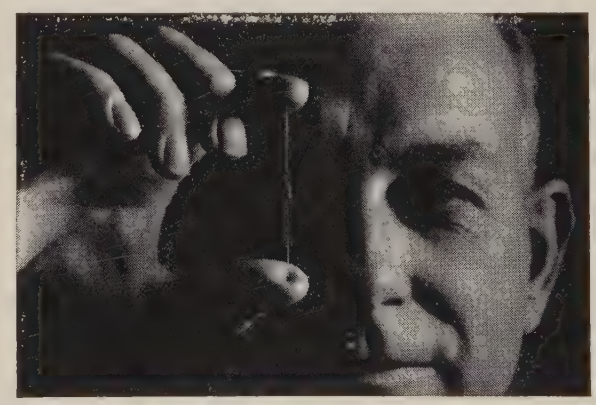
Information resulting from Hughes study in the fields of air-to-air and ballistic guided missiles is presently paying dividends into the fund of space knowledge.

Hughes engineers have developed space hardware using high-reliability wire wrapping to replace soldered connections and miniaturized "cordwood" circuit modules to allow high component density.

The advanced nature of Hughes electronic systems—in the air, on the ground, and for industry—provides an ideal growth environment for the graduating or experienced engineer interested in building rewarding, long-range professional stature.



Data Processors, which monitor hundreds of aircraft and store the information for high-speed assignment of defense weapons, comprise one part of an advanced Hughes ground defense system.



Capacitors which provide for electrical, rather than mechanical tuning of circuits, are being produced by Hughes Products, the commercial activity of Hughes.

Members of our staff will conduct

CAMPUS INTERVIEWS

on March 2. For interview appointment or informational literature consult your College Placement Director.

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the West's leader in advanced electronics

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Culver City, El Segundo,
Fullerton and Los Angeles, California
Tucson, Arizona

STRAIGHT TALK TO ENGINEERS

from Donald W. Douglas, Jr.

President, Douglas Aircraft Company

I've been asked whether non-aeronautical engineers have good prospects for advancement in the aviation industry.

The answer is *yes, definitely!* At Douglas many of our top supervisory people have moved up from other engineering specialties. The complexity of modern aircraft and missiles requires the greatest variety of engineering skills known to industry.

For example, we now have pressing needs for mechanical, structural, electrical and electronics engineers in addition to aerodynamicists, physicists and mathematicians. Whatever your background in the engineering profession may be, there are prime opportunities in the stimulating aircraft and missiles field.

Please write to Mr. C. C. LaVene
Douglas Aircraft Company, Box 6101-Q
Santa Monica, California

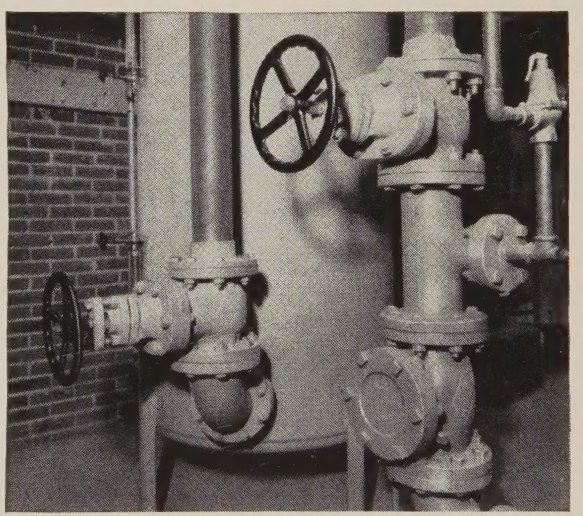
Architect and Consulting Engineer: GANTEAUME & McMULLEN, BOSTON • *General Contractor:* TURNER CONSTRUCTION COMPANY, BOSTON
Heating and Air Conditioning Contractor: THE MERRILL COMPANY, INC., BOSTON • *Plumbing Contractor:* M. AHERN CO., BOSTON

New Boston Globe Building relies on JENKINS VALVES

When the Boston Globe moved into this modern newspaper plant, it *made* news. A showplace for passersby with its battery of 37 presses turning out the news in a "picture window" two stories high, the new $12,000,000 home of the 86-year-old Globe is a model of efficient operation.

Efficiency is seen throughout the building plan. For example, practically all mechanical departments are on the first floor. The stress on efficient, trouble-free operation is equally evident in the equipment specifications which provided for utmost dependability in everything mechanical. To assure complete dependability in the control of water, air, gas, heating and air conditioning lines, Jenkins Valves were chosen.

Because of such confidence, "JENKINS" has been the trusted valve specification of three generations of building men. Yet the valves that have this well-earned confidence *cost you no more. . . .* Jenkins Bros., 100 Park Avenue, New York 17.



These valves on the cooling system for press plates are among 1,402 Jenkins Valves serving the 15-acre Globe building.

Sold Through Leading Distributors Everywhere

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864
Jenkins Bros

Begged, Borrowed, and . . .

Edited by The Staff

Baby Carriage: Last year's fun on wheels.

* * *

A smart girl is one who knows she can get more from Santa if she leaves her legs in the stockings.

* * *

An expectant father phoned the doctor to rush right over. "Is she laboring?" asked the doctor.

"Hell no!" replied the man, "She's in bed yelling her head off and I'm doing all the work."

* * *

He: "Pardon me, but you look like Helen Greene."

She: "So what? I look worse in pink."

* * *

A Texas oil man was visiting New York. His city friend showed him all of the sights including the Empire State building.

"Isn't that a gigantic structure?" asked the friend.

"Naw, that isn't so big," drawled the Texan, "We've got outhouses in Texas bigger than that."

"Well," drawled back the New Yorker, "I guess yuh need 'em."

* * *

In Paris, it's frankness;
In Panama, it's life;
In a professor, it's clever;
But in a college magazine,
It's smutty.

* * *

C.E.: "How did you puncture that tire?

E.E.: "Ran over a milk bottle."

C.E.: "Didn't you see it?"

E.E.: "Naw, the kid had it under his coat."

* * *

Overheard at Food Service:

First Cook: "Hey, the garbage man is outside."

Dietician: "O.K., tell him to leave three cans today."

If ever a new Statue of Liberty is designed, it will be holding the bag instead of a torch.

* * *

You can't fool all the people all the time . . . some of them are fooling you.

* * *

A bosom companion sometimes turns out to be a false friend.

* * *

First Father: "Has your son's liberal arts education proved helpful since you took him into the business?"

Second Father: "Oh yes, whenever we have a board meeting we let him mix the cocktails."

* * *

Girl: "Isn't that a lovely moon tonight?"

Boy: "I'm not interested in astronomy now, and besides I'm in no position to say."

* * *

"I shall now illustrate what I have on my mind," said the E.E. professor as he erased the board.

* * *

"Really, Bill, your argument with your wife was most amusing."

"Wasn't it though? When she threw the axe at me, I thought I'd split."

* * *

An inmate of a certain insane asylum, feeling that he had recovered enough to be released, appeared before the desk of the superintendent. After he was partially examined he was asked the following question:

Superintendent: "If we discharge you, will you promise to let women and liquor alone?"

Inmate: "Yes, sir."

Superintendent (beckoning a guard): "Lock him up; he's still crazy."

* * *

Only one man in a thousand is a leader of men. The other 999 are followers of women.

Two rabbits were being chased by a pack of wolves when one turned to the other and said:

"What are we running for, let's stop and out-number them."

The other rabbit said:

"Keep running, bud, keep running . . . we're brothers."

* * *

Then there was the fellow who had the hobby of collecting stones and keeping them in his bathroom.

He had rocks in his head.

* * *

She: "There's one thing I want to tell you before you go any further."

He: "What's that?"

She: "Don't go any further."

* * *

Him: "May I take you home? I like to take experienced girls home."

Her: "I'm not experienced."

Him: "You're not home yet, either."

* * *

Progress is so great these days that the liberal artist who says it can't be done is generally interrupted by an engineer doing it.

* * *

He: I understand kisses speak the language of love.

She: Yes?

He: Let's talk things over.

* * *

He: Say something soft and sweet.

She: Custard pie.

* * *

A customer at a bar ordered a dozen Manhattans. He poured the liquor on the floor, and began munching contentedly on the glasses themselves. The stems, however, he would not touch.

A barfly watched the performance with absorbed interest, and then pointed to the twelve stems. "You darn fool," she said, "you're leaving the best part."

* * *

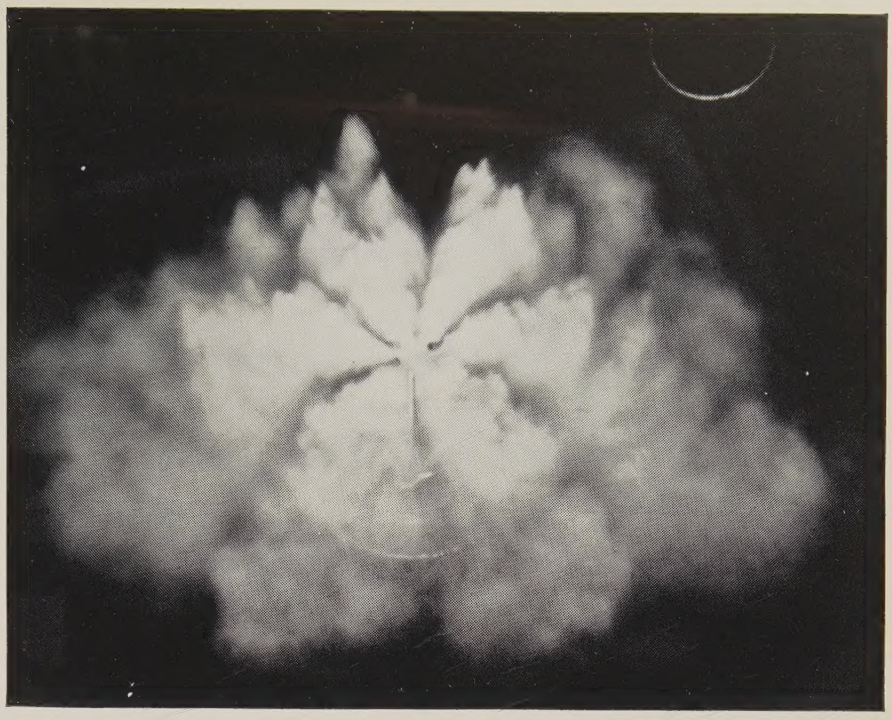
"Let's organize a fraternity."

"Why?"

"I've just discovered a new grip."

PHOTOGRAPHY AT WORK
No. 33 in a Kodak Series

The Army's first operational rotor-tip propelled jet helicopter—built by Hiller.



The camera has caught the fuel spray pattern within the rear end of the ram-jet engine even though passing by at about 450 miles per hour.

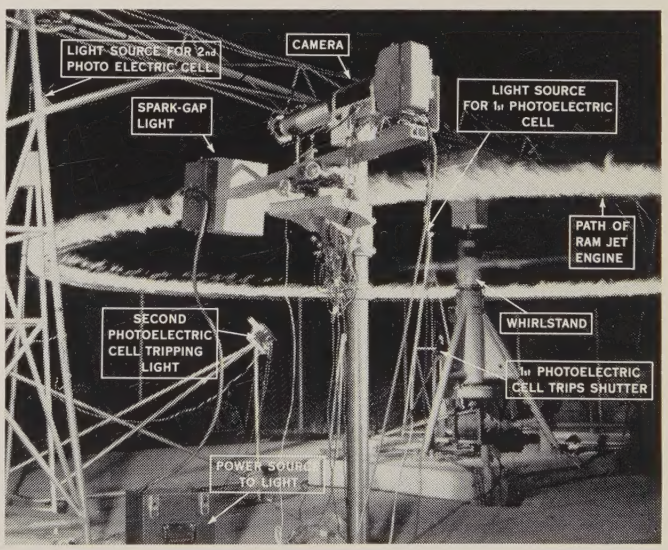
Project: Inspect rotor tip jets for a whirlybird

Hiller Helicopters wanted facts on the fuel spray pattern of a ram-jet engine whirling at speeds up to 700 feet per second. Photography got the job.

WHEN HILLER HELICOPTERS of Palo Alto, Cal.—a pioneer in vertical take-off aircraft—developed a rotor-tip ram-jet engine, they knew the fuel spray would be subject to high air velocity and centrifugal force up to 1200 G's. Would the fuel spray be deflected outward and cause the jet to lose thrust? They wanted to know. So they set up the camera with its fast eye to catch what otherwise couldn't be seen. And they learned the right angle of air intake and nozzle to obtain the greatest power.

Using photography in research is an old story with Hiller—just as familiar as using it for improving public relations. It's an example of the way photography plays many important roles in modern-day industry.

In whatever work you do you will find that photography will play a part in improving products, aiding quality control and increasing sales.


LIGHT SOURCE FOR 2nd PHOTO ELECTRIC CELL
CAMERA
SPARK-GAP LIGHT
LIGHT SOURCE FOR 1st PHOTOELECTRIC CELL
PATH OF RAM JET ENGINE
SECOND PHOTOELECTRIC CELL TRIPPING LIGHT
WHIRLSTAND
1st PHOTOELECTRIC CELL TRIPS SHUTTER
POWER SOURCE TO LIGHT

This is all the human eye could have seen of the whirling ram-jet engine as camera takes its picture.

CAREERS WITH KODAK

With photography and photographic processes becoming increasingly important in the business and industry of tomorrow, there are new and challenging opportunities at Kodak in research, engineering, electronics, design and production.

If you are looking for such an interesting opportunity, write for information about careers with Kodak. Address: Business and Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N. Y.

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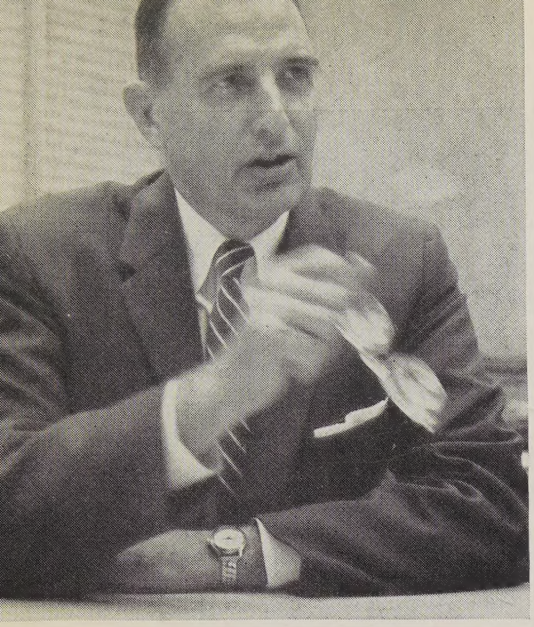

*One of a series**

Interview with General Electric's W. Scott Hill Manager—Engineering Recruiting

Qualities I Look For When Recruiting Engineers

Q. Mr. Hill, what can I do to get the most out of my job interviews?

A. You know, we have the same question. I would recommend that you have some information on what the company does and why you believe you have a contribution to make. Looking over company information in your placement office is helpful. Have in mind some of the things you would like to ask and try to anticipate questions that may refer to your specific interests.

Q. What information do you try to get during your interviews?

A. This is where we must fill in between the lines of the personnel forms. I try to find out why particular study programs have been followed, in order to learn basic motivations. I also try to find particular abilities in fields of science, or mathematics, or alternatively in the more practical courses, since these might not be apparent from personnel records. Throughout the interview we try to judge clarity of thinking since this also gives us some indication of ability and ultimate progress. One good way to judge a person, I find, is to ask myself: Would he be easy to work with and would I like to have him as my close associate?

Q. What part do first impressions play in your evaluation of people?

A. I think we all form a first impression when we meet anyone. Therefore, if a generally neat appearance is presented, I think it helps. It would indicate that you considered this important to yourself and had some pride in the way the interviewer might size you up.

Q. With only academic training as a background, how long will it be before I'll be handling responsible work?

A. Not long at all. If a man joins a training program, or is placed directly on an operating job, he gets assignments which let him work up to more responsible jobs. We are hiring people with definite consideration for their potential in either technical work or the management field, but their initial jobs will be important and responsible.

Q. How will the fact that I've had to work hard in my engineering studies, with no time for a lot of outside activities, affect my employment possibilities?

A. You're concerned, I'd guess, with all the talk of the quest for "well-rounded men." We do look for this characteristic, but being president of the student council isn't the only indication of this trait. Through talking with your professors, for example, we can determine who takes the active role in group projects and gets along well with other students in the class. This can be equally important in our judgment.

Q. How important are high scholastic grades in your decision to hire a man?

A. At G.E. we must have men who are technically competent. Your grades give us a pretty good indication of this and are also a measure of the way you have applied yourself. When we find someone whose grades are lower than might be expected from his other characteristics, we look into it to find out if there are circumstances which may have contributed.

Q. What consideration do you give work experience gained prior to graduation?

A. Often a man with summer work experience in his chosen academic field has a much better idea of what he wants to do. This helps us decide where he would be most likely to succeed or where he should start his career. Many students have had to work hard during college or summers, to support themselves. These men obviously have a motivating desire to become engineers that we find highly desirable.

Q. Do you feel that a man must know exactly what he wants to do when he is being interviewed?

A. No, I don't. It is helpful if he has thought enough about his interests to be able to discuss some general directions he is considering. For example, he might know whether he wants product engineering work, or the marketing of technical products, or the engineering associated with manufacturing. On G-E training programs, rotating assignments are designed to help men find out more about their true interests before they make their final choice.

Q. How do military commitments affect your recruiting?

A. Many young men today have military commitments when they graduate. We feel it is to their advantage and ours to accept employment after graduation and then fulfill their obligations. *We have a limited number of copies of a Department of Defense booklet describing, in detail, the many ways in which the latter can be done. Just write to Engineering Personnel, Bldg. 36, 5th Floor, General Electric Company, Schenectady 5, N. Y.* 959-8

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